MANUSCRIPT NOTES ON WEAVING

BY

JAMES HOLMES, M.S.A.

FIRST YEAR

1915

The Sample cloths must
be worked out in the
design Book. after each lesson

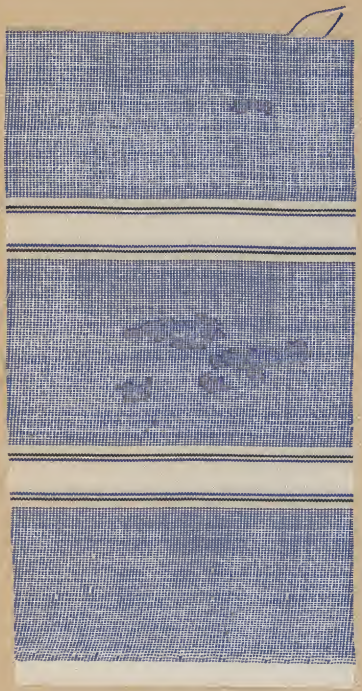
WEAVING - (DESIGNING)

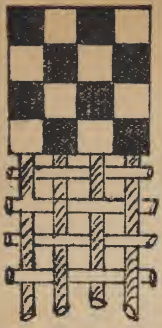
If you examine a piece of plain cloth through a magnifying glass, it will appear the same as shown in the lower part of fig. 1; the vertical lines equal warp ends and the horizontal lines picks of weft. The upper part of the fig. gives a piece of design paper much enlarged, also with the squares filled in and left blank to suit the pattern of plain cloth given below it. A row of squares across the paper equals a pick of weft, a row of squares down the paper a warp end; whenever a warp end is lifted a square is filled in. In a plan of the cloth. (fig. 1) on the first pick, the second and fourth ends are lifted, therefore on the first row of squares, the second and fourth are filled in, and so on for the four picks.

Fig. 2. gives a three end twill

Fig. 3. gives a four end twill

Fig. 4. gives a five end satin





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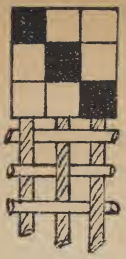

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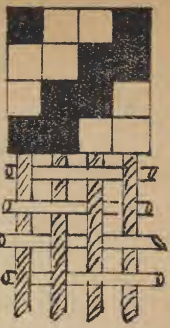

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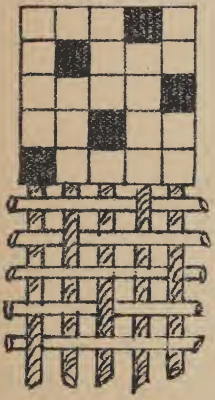

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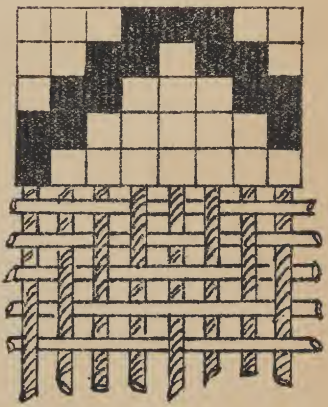

5.

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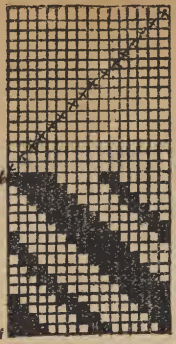
H.



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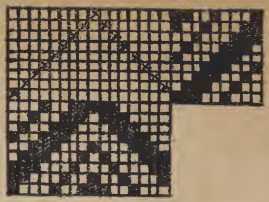

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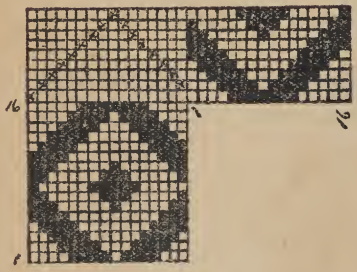

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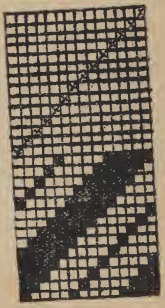

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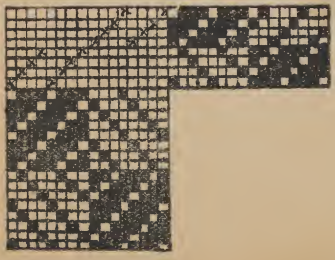

14

16 H.

Fig 5. a wave across the piece

Figs. 6. 7. 8. 9 and 10. shows the same patterns placed on ordinary design paper, the crosses above the patterns indicating the looming.

Fig 11 gives a twill made on 16 healds.

Fig 12, a wave across the piece.

Fig 13 a small spot figure, either of the two figs 12 and 13 can be made on 9 healds to the looming and pegging plan given, or on 16 healds if the looming is straight draft. Fig 14 is a pattern requiring 8 healds with the looming and pegging given, or 16 healds straight draft. Fig 15 is a 14 heald twill, and fig. 16 a wave down the piece using 14 healds.

Show on design paper, the design, looming, and pegging plan for the cloth given to you.

Make a number of twills on 8. 9. 10 and 12 healds.

James Holmes. M&A Burnley

Weaving (Designing)

The patterns given in figs 11. 12. 13. 14. 15 and 16. are such as can be woven on 14 and 16 staves, according to the number of threads occupied by each pattern; they are given so that the student may peg the lattice, and see the actual cloth woven in the looms.

Twills may be made on any number of staves from three upwards, the number of threads lifted on each pick are the same, the filled in squares or threads advancing one to the right or the left on each pick depending upon the direction the twill is running.

Fig 17 gives a 5 end twill 2 up 3 down.

Fig. 18. gives an 8 end twill 4 up 4 down

Fig 19. gives the same pattern, it must be repeated until it occupies the whole of the space given.

Fig 20 gives a 10 end twill with the line of twill running up the piece from left to right; Fig 21 gives a 10 end twill running the opposite direction

Figs 22. 23. 24 and 25 are twills incomplete, the student to complete them.

Fig 26 gives a 12 end twill: on the space fig. 24 arrange a 12 end twill, show the same—

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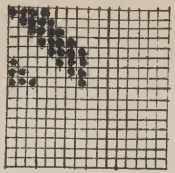

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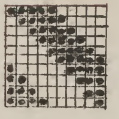

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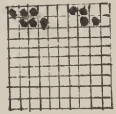

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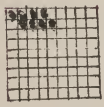

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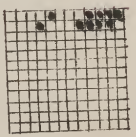

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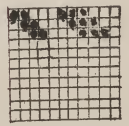

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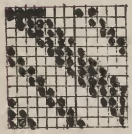

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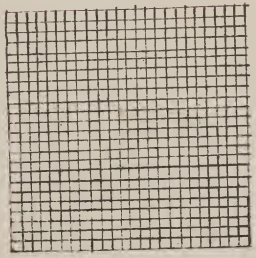

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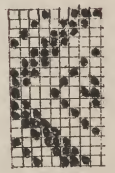

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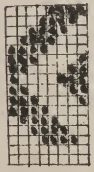

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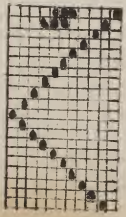

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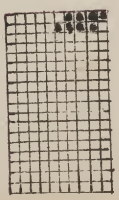

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H.

Pegging Plan
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32
Pegging Plan
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33
Pegging Plan
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Pegging Plan
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Pegging Plan
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36
Pegging Plan
14
37

H.

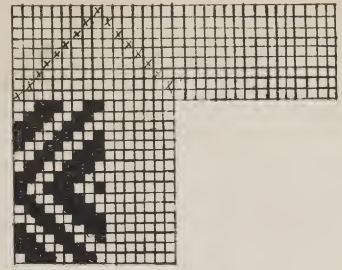
repeating to occupy 24 ends and 24 picks.
Fig. 28 gives a wave drawn the piece using 9 staves
Fig 29 gives another example on 8 Staves. Figs 30 and 31 to be completed.
Fig 32 shows a wave across the piece, the crosses indicate the looming, the pegging plan is also given. Fig 33 gives a wave showing design and looming, the pegging plan to be put in the place provided. Fig 34 gives another wave the looming and pegging plan to be filled in.
On the space fig 35 make a wave pattern on 10 staves showing looming and pegging plan.
Fig 37 shows a small spot figure with looming and pegging plan.
Fig 36 gives a spot figure. place in the spaces provided for the purpose the looming and pegging plan

James Holmes MSA Burnley.

All spot figures made after the style of fig 34. will be found to repeat in ends and picks on twice the number of heads used less two. the example fig 34 stands complete on 16 ends and 16 picks, the number of heads used is 9, therefore twice 9 equals 18 less 2 gives 16 the number of ends and picks required to complete the pattern.

Fig. 38 gives a part completed pattern of a spot weave, complete the pattern to the looming given, also put in the pegging plan; fig. 39 gives an 8 end twill, make it into a spot figure, using the looming given, also pegging fig 40 gives a spot figure on 5 heads, repeat it until it fills the space provided for it: on the space fig. 41 make a spot figure of your own designing using the looming given show pegging plan.

WAVES ACROSS THE PIECE can be increased in depth without increasing the number of staves used, as shown in fig. 42 where the depth of the wave is increased to 12 picks to the round before it begins to turn, this is brought about by going three times through from front to back and three times through from back to front in the looming, using only four heads, in fact the



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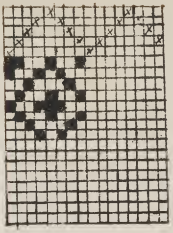

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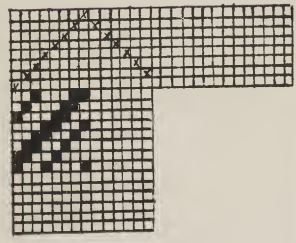

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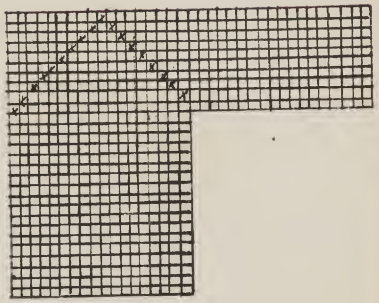

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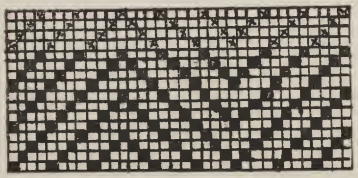

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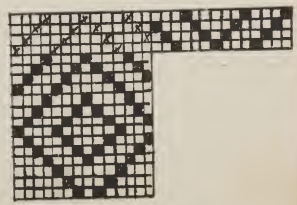

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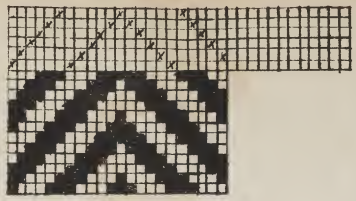

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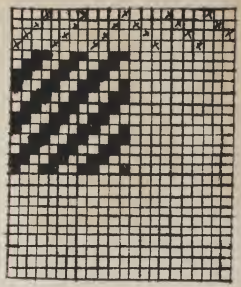

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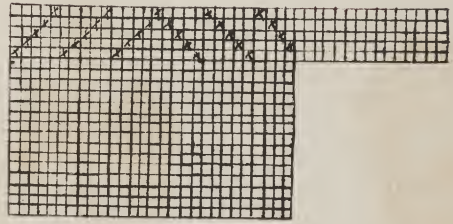

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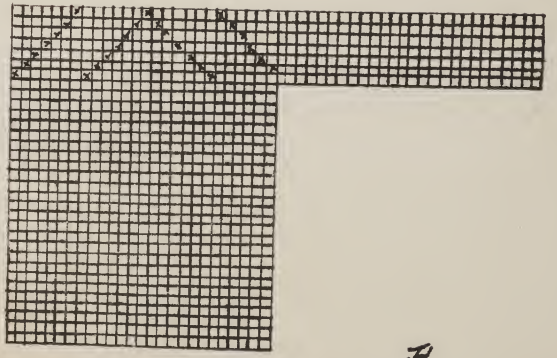


47.

A.

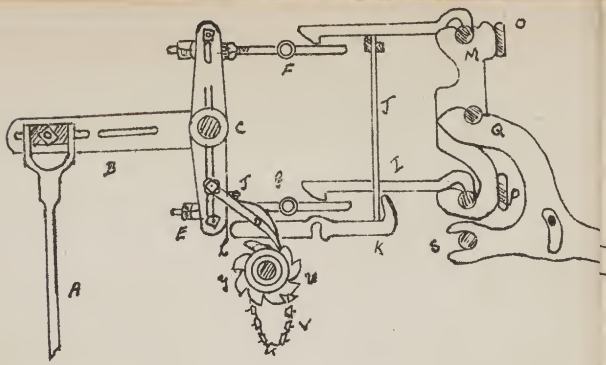
whole effect is obtained by the way in which the ends are drawn through the healds. The depth of the wave can always be found by multiplying the number of healds used by the number of times through in the looming.

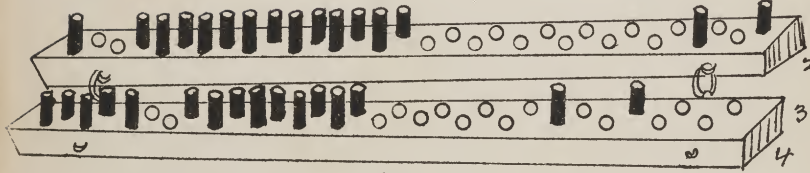
In fig. 43 the depth of the wave is 12 picks, the number of healds used 6; therefore twice 6 equals 12, the depth of the wave in picks: on the space fig. 44 put down a wave pattern of your own designing to the looming given, show pegging plan

SPOT FIGURES can be increased to almost any size both in ends and picks, using only a few number of healds; fig. 45 gives an example using 4 healds, the size of the pattern being 14 ends and 14 picks, this is brought about by a combination in the looming and pegging, both of which are shown along with this pattern. Fig. 46 is required to be completed on the same lines as fig. 45, so that one complete pattern stands on 22 ends and 22 picks. Make a spot on space 47 after the style of fig. 45 — James Holmes. M&A.

WEAVING - THE DOBBY MACHINE.

The type of dobby in most common use in Lancashire and Yorkshire is what is known as the "Keighley Dobby" patented by Hattersley and Smith in 1868; Since the patent expired, nearly all loom makers have a special construction of this machine. The dobby is a shedding machine used for conveniently working the healds up to 30 staves, or for Dhooty borders up to 40; by the aid of pegs placed in a revolving lattice any heald can be selected and raised by the machine, a peg indicating a heald up, a blank heald down. Fig 48 gives a view of the essential parts of the machine. A is a rod worked from a crank fixed on the end of the bottom shaft. A is attached to B, with arms E.D. working on the fulcrum C, to the ends of D E are sliding knives F and G working in the grooves in the framing of the machine, resting over F and are catches H and I. The end of these are attached to the upright bar M.N, attached to M N is the lever Q working on its fulcrum at S, at the other end of the lever at the point R. The healds W are attached. U is the barrel carrying the lattice V for the pattern, it is so made that 8 cages are required to go once





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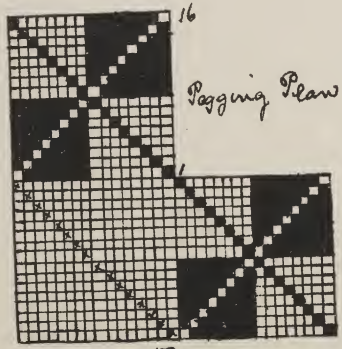
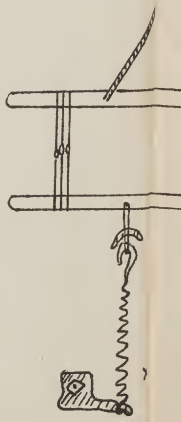
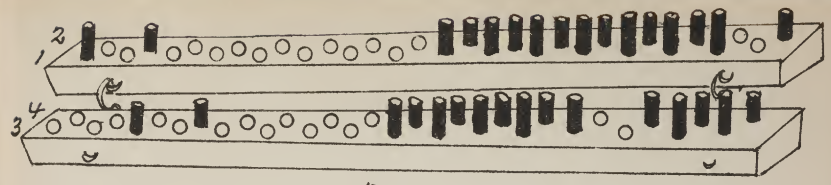


Pegging Plan





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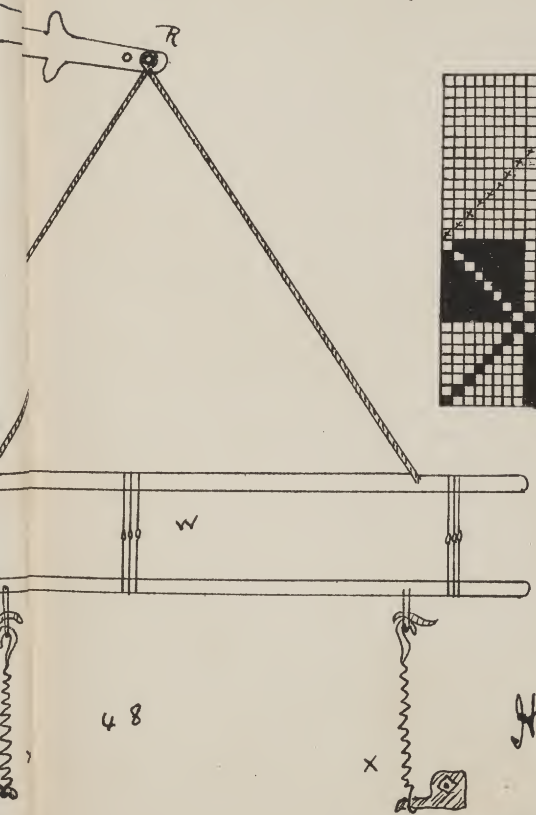

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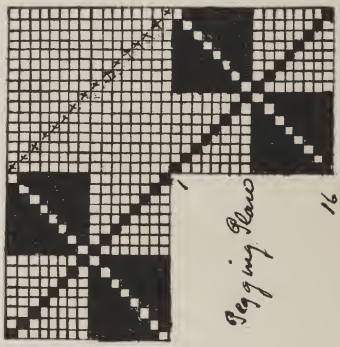

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Sagging Plaid

16

round it; resting on the topmost lag are a number of heavy end levers L, just double the number to what there are levers E in the machine, the other ends of L hold up the catches H. I, the catch I is held up direct and H. through the medium of the needle J; G is a ratchet wheel of 8 teeth fixed to the end of the barrel; T a pawl attached to E, its uses are to work the barrel.

Its action is this— If a lag is in gear without any pegs, all catches I and H are lifted out of the way of the sliding knives, and no healds are lifted, if a lag is in gear with all the holes pegged, all the healds are brought up on the next pick, so that by pegging a lattice to suit a pattern, the healds are lifted to suit the blanks and pegs in the lattice, and any order of lifting for any heald may be obtained; the healds after being lifted, are brought to their lowest point by the springs X

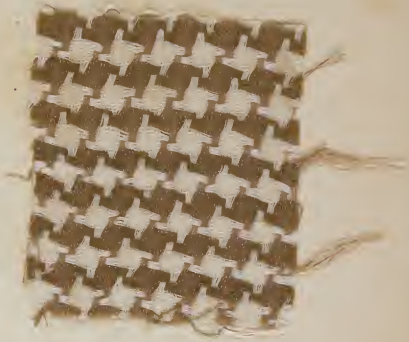
Fig 49 gives a pattern, looming and pegging; fig 50 shows the same pattern turned round, so as to enable the pegging plan to be better understood; the picks are numbered from 1 to 16; fig 51 shows the pegging for a "Right Hand Dobby"; 52 pegging for a

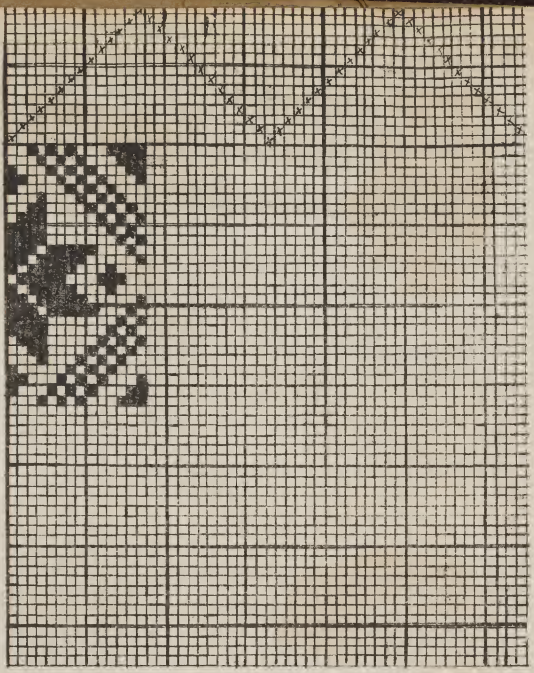
Fig 53 gives the lifting plan for an all over spot figured effect; from the looming shown above the space, put down the pattern repeating it until it covers the whole of the space provided for it, this can be done from the looming and pegging combined. The first 14 ends of the pattern are all weaving differently, therefore 14 separate healds are required, the 15th end is drawn on the same heald as the 13th end, therefore the 15th is put down on design paper just in the same order of lifting as the 13th; the 16th is drawn on the same heald as the 12th, therefore the 12th and 16th ends are both alike on design paper, and so on until every space is taken up; a much quicker way is to note the direction of the looming, and whenever it turns there will be a like turning in the pattern, in the example under consideration the ends are drawn in from front to back, from 1 to 14, the order is then reversed from 14 to 1, so that the pattern from 14 to 26 ends is the same as from 1 to 14 but in the reverse order; the same method is applied to a large number of "centred" or "turned over" patterns, both for simple dobby cloths and jacquards, it enables the pattern to be increased to almost double the size without increasing the number of healds used.

SEE "COTTON CLOTH DESIGNING-" PLATE 8.

CLOTH SAMPLES

Fig 53B gives a sample of cloth, on the space 53A put down the design looming and pegging plan; in getting out the pattern from a piece of cloth, the usual way is to make a fringe about ¼" long on the upper and left hand edges, then pull out a pick of weft from the upper edge, and note down on design paper, by means of filled in squares whenever a warp end is above the weft, working from left to right, carry it out until the pattern repeats; then pull out a second pick, noting as before how the warp and weft interweave, whatever is seen is placed underneath the 1st pick on design paper, this is repeated pick after pick





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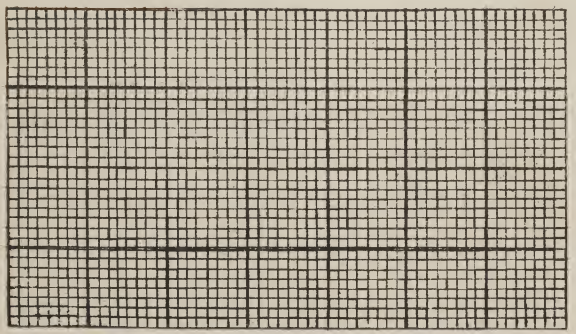
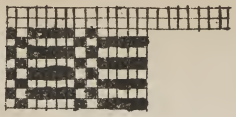


53A

53B
CLOTH

H.



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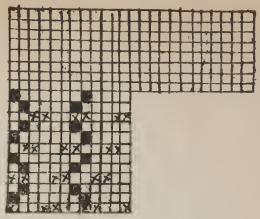

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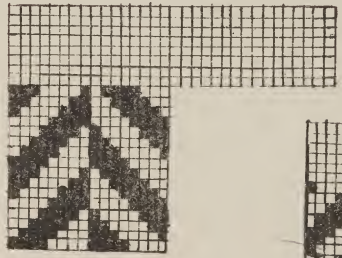
55-A CLOTH



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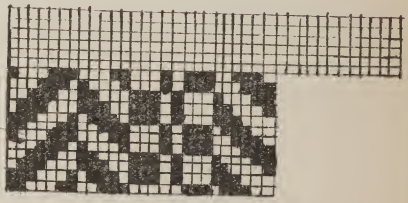

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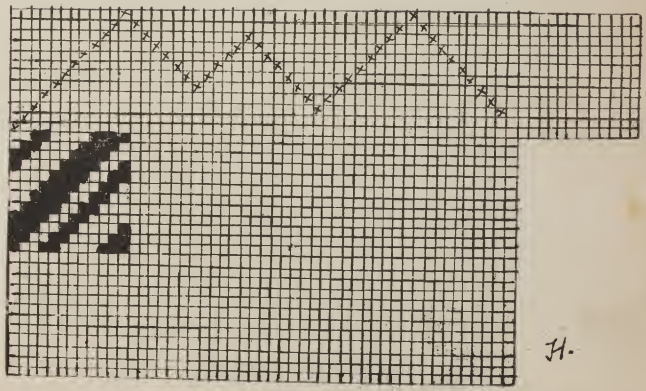


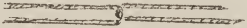
58

TH.

H.

until the pattern repeats, another and a quicker method is to note the particular weave there is in a pattern and to place the pattern on design paper direct from the cloth. This can easily be done in regular patterns, and is a rapid and convenient method especially for coloured goods, painting the pattern up on design paper in the different colours of the threads used.

TESTING FOR WARP & WEFT & COUNTS OF YARN.
To find which is the warp and weft threads; after making the fringe before mentioned take the sample between the finger and thumb of each hand, and pull tightly, and in the warp ways you will see the threads fly asunder just as in the act of shedding, the warp threads are also stiffer, due to sizing, and more free from outstanding fibres.
TESTING FOR THE COUNTS. Take out a few threads from the sample, then twist them with a similar number of threads from a known sample counts thus.


untwisted


Twisted together

it will easily be seen which is the coarser thread, and a little practice and judgment will enable the student to determine how much finer or coarser the yarn is from the known sample: for example give the counts of warp and weft in the cloth fig 53 B. judging from the known counts supplied to you.
Fig 55 gives the design for the cloth 55 A, the crosses indicate the ground weave of the pattern, left in looming and pegging. Figs 54. 56 & 57 are given to illustrate looming and pegging, fill in, in each case the full particulars. In fig 58 the filled in squares gives a twill pattern, the looming is shown above it fill in the whole of the pattern that will be produced from the looming given, completely fill the space.

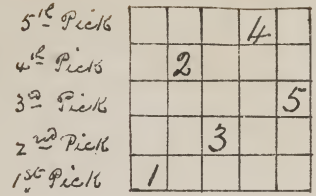
SEE "COTTON CLOTH DESIGNING"
PLATES 4. 5. 7 & 24

James Holmes M.S.A.
— Burnley. —

WEAVING - DESIGNING - SATINS -

In what are termed weft faced satins, a greater proportion of the weft floats on the face, in warp satins a greater proportion of the warp, in both cases, a smooth even cloth without figure is obtained. Satins can be made on any number of ends from four upwards, four and six giving imperfect satins; In selecting the binding points, or lifting of the healds, satins have a constant number of their own for a basis, depending upon the number of healds used, some of them have several constant numbers for a basis; to find this number for any particular satin, let it be such that it will not divide equally into the number of healds used, let it also be such that it cannot be equally divided by any other number which will divide exactly into the number of healds used, having found such a number the same is taken for a basis to find how the ends should lift in the satin under consideration; taking for example a 5 end satin, the number which can be taken as a basis is 2, therefore as shown in fig. 59; on the 1st pick lift the 1st end; on the 2nd pick, miss one square less than the num taken as a basis and lift the 3rd end; 3rd pick miss one empty square and l the 5th end; on the 4th pick the 2nd end is lifted; on the 5th pick the 4th end is the numbers in the squares indicating the lifting of the respective threads, more clearly in fig 60.

Fig 61 shows the order of lifting for an eight end satin, using a bas it will be seen that 2 empty squares are left, between the lifting o ends from one pick to the other. Fig 62 shows the squares prop



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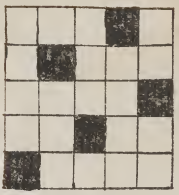

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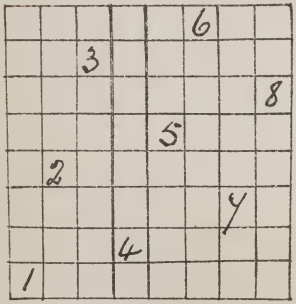

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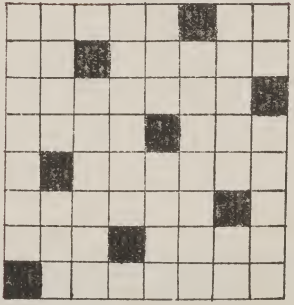

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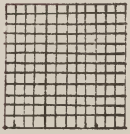

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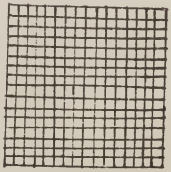

71

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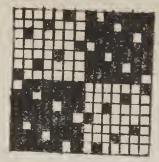
72



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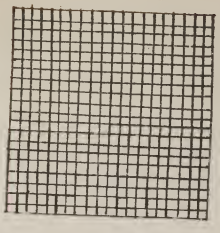

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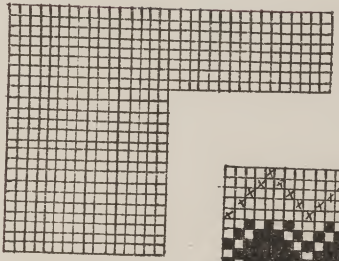

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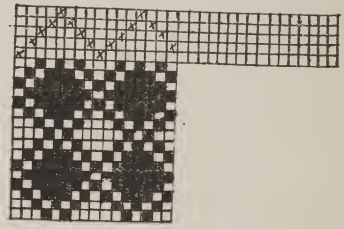

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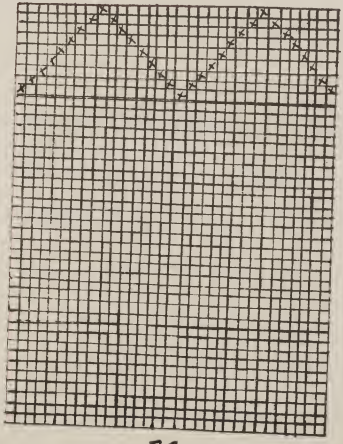

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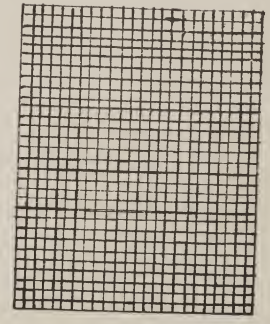


79

24.

filled in for an 8 end satin. Fig 63 gives a 4 end satin or Satinet it is imperfect, because no number can be taken for a basis which fulfils the conditions laid down, the same remarks apply to fig 64 which is a 6 end satin. Fig 65 is a 7 end satin with a basis of 2; fig 66 a 9 end satin, basis 2; fig 67 a 10 end satin basis 3 fig 68 a 10 end warp satin showing contrary sides of the cloth to fig 67. On the space 69 make a 12 end weft satin; on the space 70 make a 12 end warp satin; on the space 71 make a 16 end weft satin. Many good examples of "checked" or "Dice" effects can be made using warp and weft satins in combination; fig 72 gives an example using 10 healds; fig 73 another example using 14 healds; the checks may be increased to almost any size, without using any more healds, by an alteration in the looming and pegging. On the space 76 make each of the checks in fig 72 four times the size, so that the complete patterns will occupy 20 ends and 20 picks. Fig 74 gives a twill check. On the space 75 increase size of 74 to occupy 16 ends and 16 picks complete patterns, by by an alteration in the looming and pegging, show fully and clearly how it is done.

HONEYCOMB CLOTHS. These cloths are generally made with the ends drawn in point draft, the number of ends and picks in the pattern then equals twice the number of healds used, less 2, taking fig 77 the repeat is 8 ends and 8 picks, show pegging; on the space 78 give a 9 end Honeycomb, show pegging plan on the space 79 give a 6 end Honeycomb, show looming & pegging.

SEE "COTTON CLOTH DESIGNING" plate 12 James Holmes M.S.A. Burnley

Checks. Fig 80 gives a warp and weft check known as a dice, or draught-board pattern, the looming and pegging plan is shown 8 heads only are used but the pattern completed stands on 16 ends and 16 picks. on the space 81 make a warp and weft check using only 10 heads for the purpose show looming and pegging, let the pattern be after the style of fig 80

on Space 82 make a 9 end satin

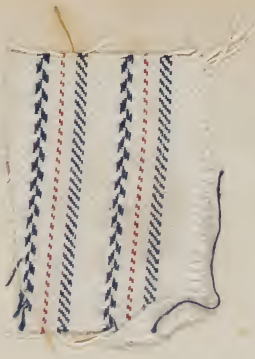
on " 83 " " 11 " "

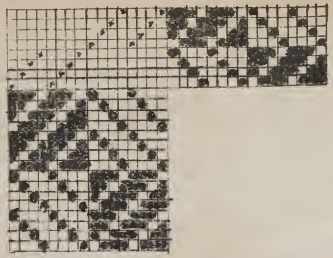
on " 84 " " 16 " "

Show looming and pegging for fig 85

The looming and pegging plan is given for fig 86 " put down the completed pattern in the space provided for the purpose

Combination Twills. A vast number of new designs can be made by taking two twills and arranging them picks and picks as illustrated by figs 87. 88 and 89 on the Space fig 89 the two twills 87 and 88 are combined pick and pick. the 1st pick is taken from fig 87 the 2nd pick from 88 the 3rd " pick from 87 the 4th " from 88 and so on until all the picks are taken up, a new design standing on 16 picks is the result, the order may be varied in an infinite variety of ways so that there is scarcely any limit to the number of designs which can be made this way,





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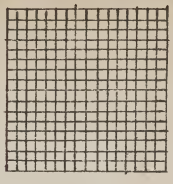

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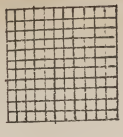

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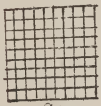

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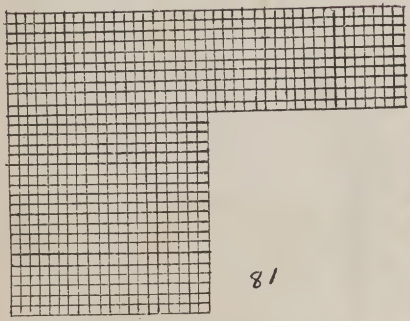

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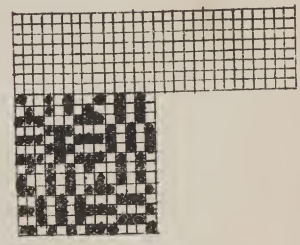

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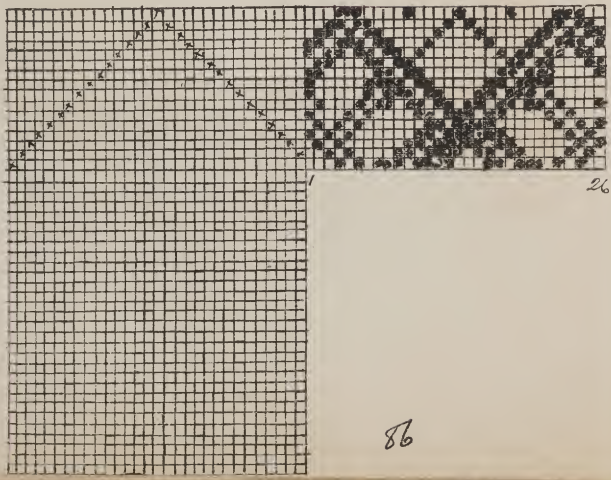

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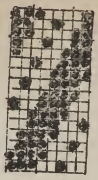

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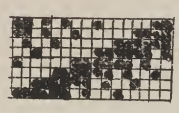

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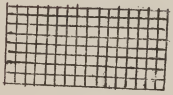

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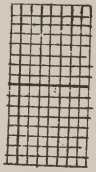

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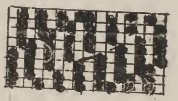

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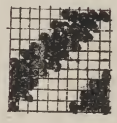

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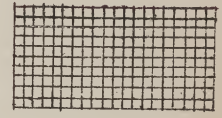

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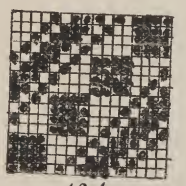

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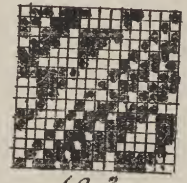

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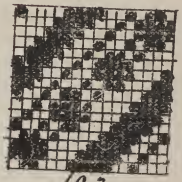

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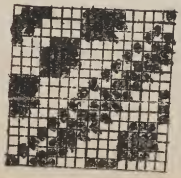

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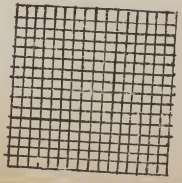


Fig 90 shows the same twills arranged end and end, the 1st end is taken from 87 the 2nd from 88 and so on until each end is taken up an new design is produced requiring. 16 healds to weave it, on space 93 make a combination twill picks way from 91 and 92; on space 94 make a combination twill ends way using 91 and 92 for the purpose

Corkscrew Twills. These are made by rearranging the threads of a twill in such a way as to produce a warp twill on both sides of the cloth to enable this to be done a greater number of threads per inch will be required to what would be used in an ordinary cloth. Fig 95 gives an 8 end twill fig 96 shows the same rearranged so that the filled in squares of one thread come opposite to the blanks of the next thread: Fig 97 gives 10 end twill on space 98 rearrange 97 so as to make a corkscrew twill after the style of 96. on space 99 make a 6 end twill on space 100 rearrange 99 and make a corkscrew twill.

Fancy Twills. Figs 101 to 105 both inclusive gives a number of fancy twills, they are all on 16 ends and 16 picks. on space 106 make a fancy twill

James Holmes Ald. Bromley

Weaving

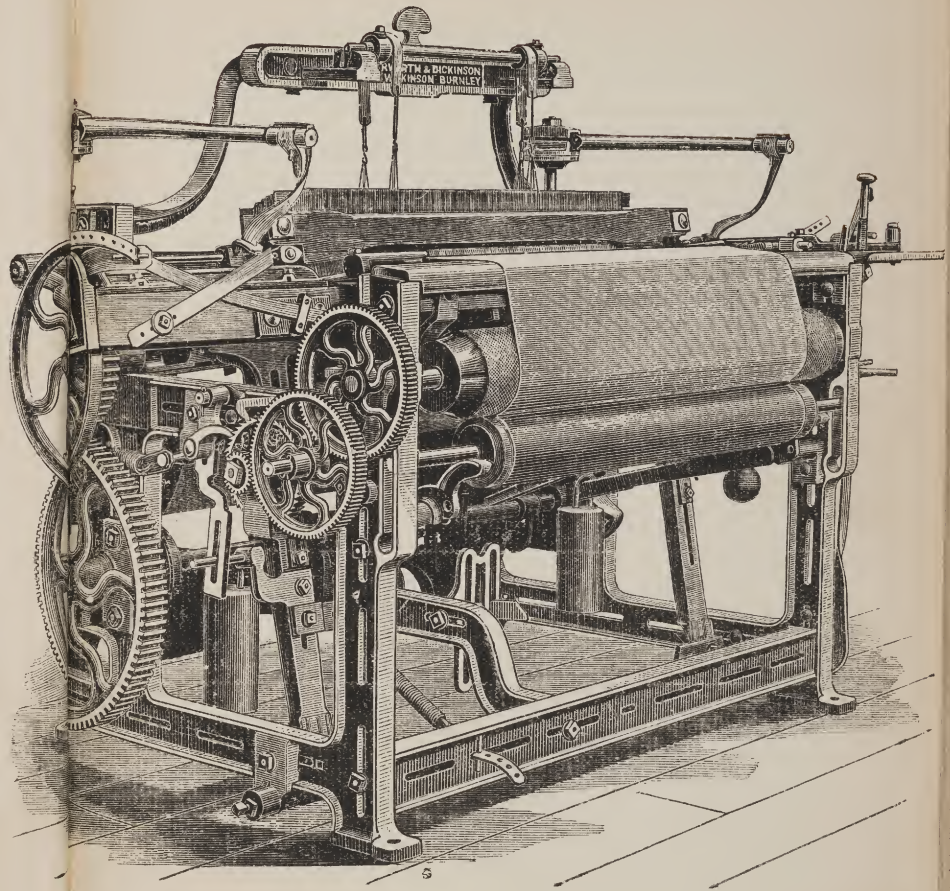
When Dr. Cartwright in the year 1784 first conceived the idea of inventing a loom to run by power, he had never seen a person weave on the hand looms then in common use. The incidents which led Dr. Cartwright to seriously consider the making of a weaving machine is told in the following story by himself.

Happening to be in Matlock in the summer of 1784 I fell in with some gentlemen from Manchester, when the conversation turned on Arkwright's spinning machinery: one of the company observed that as soon as Arkwright's patent expired, so many mills would be erected and so much cotton spun, that hands could never be found to weave it. To this observation I replied that Arkwright must then set his wits to work to invent a weaving machine. This brought up a conversation on the subject, in which the Manchester gentlemen agreed that the thing was impracticable, and in defence of their opinions, they adduced arguments which I certainly was incompetent to answer, or even comprehend being totally ignorant of the subject, having never at that time seen a person weave. I controverted however the impracticability of the thing, by remarking that there had lately been exhibited in London an automaton figure which played chess. Now you will not assert gentlemen said I, that it is more difficult to construct a machine to weave, than one which shall make all the variety of moves, which are required in such a complicated game. Some little time afterwards a particular circumstance recalled this conversation to mind, it struck me according to the conception I then had of the business, only three movements

would be required to follow each other in succession, there would be little difficulty in producing and repeating them.
Full of these ideas I immediately employed a carpenter and a smith to put them into effect. As soon as the machine was finished, I got a weaver to put in a warp, which was of such material as sail cloth is made from. To my great delight a piece of cloth was woven. As I had never before turned my thoughts to anything mechanical either in theory or in practice, nor had ever seen a loom at work, or knew anything of its construction, you will readily suppose that my first loom was a rude piece of mechanism; the warp was placed perpendicular, the reed fell at least with the weight of half a hundred weight, and the springs which threw the shuttles were strong enough to throw a "Congreve Rocket". In short it required the strength of two powerful men to work it at a slow rate, and only for a short time. Conceiving in my simplicity, that I had accomplished all that was desired, I then secured what I thought was a most valuable property by a patent dated april 4th 1785. This being done I then condescended to see how other people wove and you will guess my astonishment when I compared their simple operations to mine, availing myself however of what I saw I made a loom in its general principles nearly as they are made now.
Since Cartwright's day successive inventors have added and improved the loom until we have almost an ideal weaving machine.
Only three primary movements are required in the production of a piece of cloth. These are

Shedding, the seperation of the warp ends.
Picking, the throwing in of the weft.
Beating up, the carrying of the weft forward to the fell of the cloth. The other minor motions and parts of the loom, all of which are necessary for the successfully working of the loom are.
Weft fork, to stop the loom when the weft breaks.
Brake to prevent the loom running too far after the strap is thrown on to the loose pully
Stop rod, or loose reed to prevent the threads from being broken should the shuttle stop in the shed.
Shuttles to carry the weft.
Taking up motion, to pull forward the cloth as it is woven, also to regulate the picks of weft per inch.
Let off motion to regulate the letting off of the warp.
Temples to keep the cloth stretched in the loom.
Check Strap to steady and control the shuttle when it enters the box.
Fig 104 gives an illustration of a plain loom showing most of these parts.
In making figured or coloured goods many additions are made to the loom, to enable the threads of warp to be lifted in a variety of ways to produce figures; or the shuttles to be changed to enable different coloured wefts to be used.
Commencing with shedding the whole of these parts and motions will be dealt with in their turns.

James Robinson MSA Burnley.


TH & BICKINSON
KINSON BURNLEY

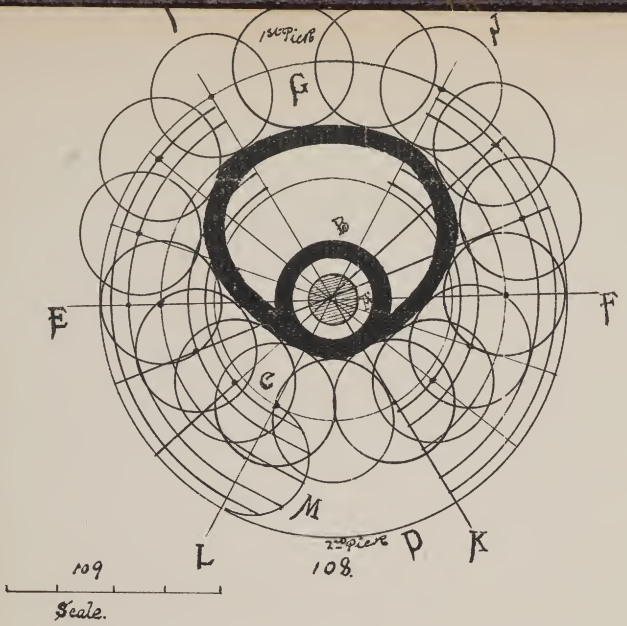
Weaving – (Shedding)

In the making of plain cloth tappets are used for changing the position of the healds, and forming the shed for the shuttle; they are of such a shape that they change the position of the healds slowley, then keep them stationary for a time sufficient to allow the shuttle to get into the opposite box, the time the healds are stationary is termed the dwell of the tappet, which varies from ½ to ⅓ of a pick; in light running looms, generally ⅓ of a pick.

The tappets are set with the crank on the top, one of the leaves is about a quarter of an inch larger than the other, the larger leaf works the back heald, so that the same size of shed is formed by both healds, at a point in front of the shuttle as it passes through the shed. It has become the custom to let the back heald rise as the pick takes place from the front side, therefore set the tappets so that the treadles are level, and so that the larger leaf will work the back heald for the first pick.

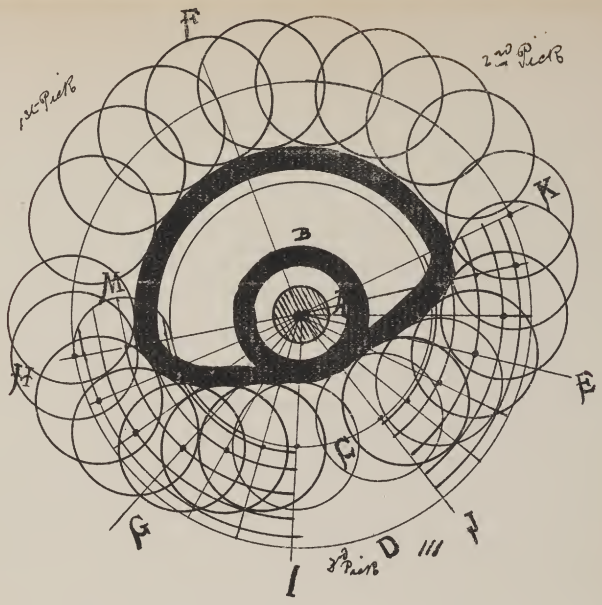
Fig 108 shows how to construct a tappet to the following particulars – Nearest point of contact with centre of tappet shaft 1 inch, Size of treadle bowl 2½ inches in diameter, Stroke of tappet 2 inches, dwell ⅓ of a pick first construct a scale ½ size of 109 from which all measurements must be taken.

Let A equal centre of tappet shaft; at 1 inch from A describe circle B which equals nearest point of contact; at 1¼ inches namely half the diameter of the treadle from A describe circle C which equals a line described by the centre of the treadle bowl as it



A

H



A

revolves in contact with nearest point of contact: 19 at 2 inches from C. describe the circle D which equals a line described by the treadle bowl as it revolves in contact with the leaf of the tappet. From C to D which equals the distance from the centre of one treadle bowl to the centre of the other, equals the stroke of the tappet, let E.F. divide the circles into as many parts as there are picks to the round, namely two: divide each pick into three equal parts, the 1st pick is divided into E I. I J. J F, the second pick E h. h K. K F. the spaces I J. and h K equals the dwell of the tappet for one complete revolution. the spaces J K and I h equal the change: divide the spaces on each side allowed for changes into 6 equal parts each, by means of radial lines from the centre: on the line h C. describe the semicircle M. divide it into 6 equal parts, and drop straight lines on to the line h C. which will then be divided into unequal spaces: taking the points where the lines drop on to h C. describe the arcs of circles shown, from A as the centre. The inner edges of the treadle bowl gives the shape to the tappet, on the line D at G describe a number of treadle bowls, the inner edges of these gives the thick line which forms the dwell: to obtain the shape to give the change, let the points where the arcs of circles of circles and radial lines cut each other as indicated by the dots be the centres of treadle bowls: describe the treadle bowls. Then draw the thick line which gives the shape to the tappet, this line may be thickened as it is in the fig. on the inner side to add strength.

Fig III is a 3 end twill tappet 2 down 1 up Stroke 2" dwell ⅓ of a pick, nearest point of contact 1½" treadle bowl 2½" dia.
make on space 110 plain tappet stroke 2" dwell ½ a pick. nearest point of contact 1" treadle bowl 2" dia.
on space 112 make a 3 end twill tappet 2 down 1 up stroke 2" dwell ½ a pick nearest points of contact 1" treadle bowl 2" dia.
construct all tappets to scale shown

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On space 113 draw a tappet for one end of the pattern fig 114. State suitable dimensions and dwell (C. G. exam paper)

State what measurements and other particulars you would require, before you proceed to draw to scale a pair of shedding tappets for plain cloth (C. G exam paper)

What faults in a set of heads will cause it to be considered a bad set. (City Guilds exam paper)

On space 115 draw a tappet for a 3 and 1 twill, one third of a pick dwell state other dimensions (C.G. E. paper)

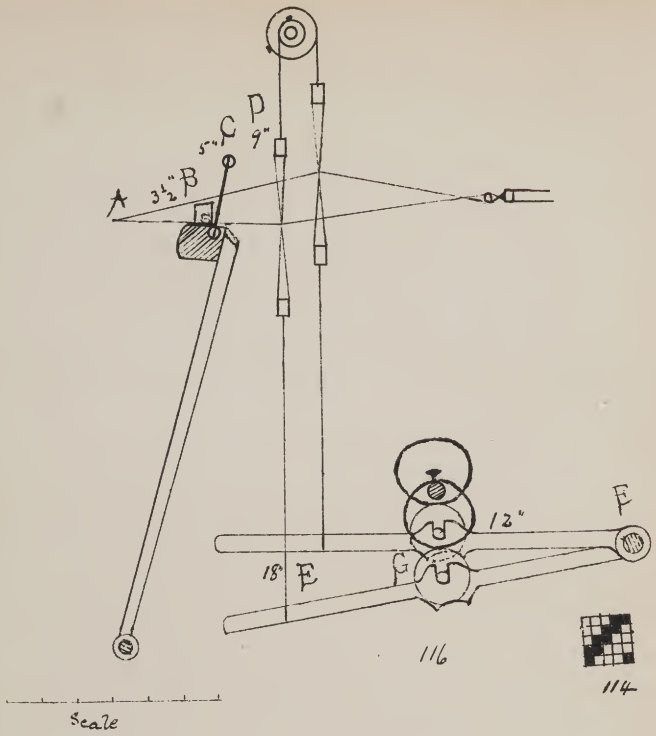
In a pair of plain wipers with one larger than the other, state which head is worked by the larger wiper and give the reason (C. G. E. paper)

When the tappets are fixed under the loom a leaf indicates in head down fig 116. when the tappets are fixed at the side of the loom a leaf indicates in head up fig 114.

Sometimes the whole of the particulars connected with a tappet are given, except the stroke and that is left to find.

Example. Find the stroke of the tappet the other particulars are Sweep of slay 5 inches; distance of heads from fell of cloth 9 inches: length of treadle 24 inches; the heads are attached at 18 inches from the treadle heel; treadle bowl 12 inches from treadle heel: Size of shuttle $1\frac{1}{8}$" deep $1\frac{1}{2}$" broad; allowing a clearance in the shed of $\frac{1}{8}$ of an inch.

In fig 116 A = fell of cloth: B = a point in front of the shuttle with the slay thrown back; C = reed



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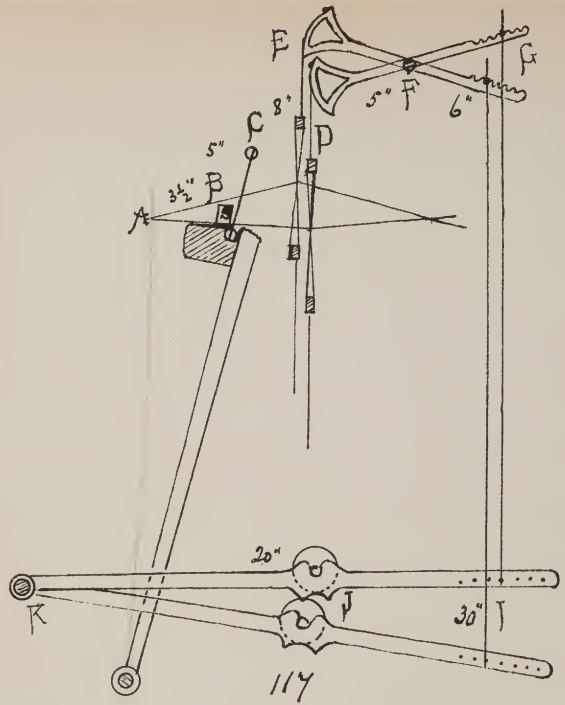


117

A

D = healds, E G F = the treadle. S = the shuttle.
At B 3½ inches from A the size of the shed equals 1¼ inches at D the size of the shed is 1¼ × 9 ÷ 3½ = 3.21 inches, the treadle at E moves down that amount; at G where the tappet acts the amount of depression = 3.21 × 12 ÷ 18 = 2.14 inches the stroke of the tappet.

When side tappets and top levers are used the calculations are rather different.

Example. In a cross rod loom, find the stroke of the tappet. Stroke of slay = 5": fell of cloth to healds 8" length of arms on top lever 5" on that side to which the healds are attached 6" on the other side: the rod from the top lever is attached to the treadle 30" from the fulcrum: the treadle bowl is 20" from the fulcrum: shuttle used 1½" broad by 1¼" deep allow ⅛" for clearance.

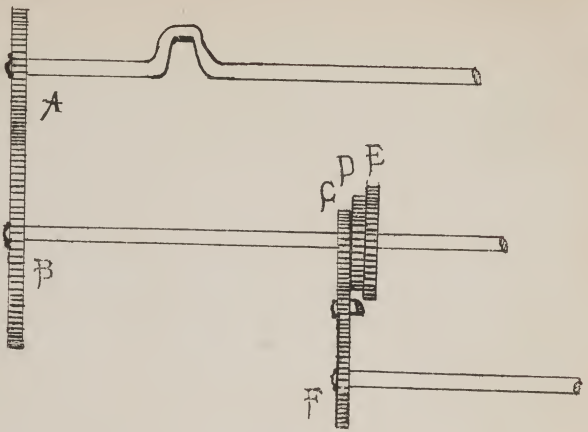
In fig 114 A = fell of cloth: B = a point in front of the shuttle with the slay thrown back: C = Reed: D = Healds: E F G = top lever: I J K = treadle.

After allowing ⅛" for clearance the size of the shed at B 3½" from A = 1¼" at D the size of the shed = 1¼ × 8 ÷ 3½ = 2.86", that is E goes up that amount G decends 2.86 × 6 ÷ 5 = 3.43". J moves through the same space; the distance through which the treadle moves at J where the tappet acts equals 3.43" × 20 ÷ 30 = 2.28" the stroke of the tappet

For calculations worked out in full and bearing on all parts of the subject the student is refered to "Calculations in Cotton Weaving" by James Holmes.

In fig. 114 is shown the arrangement of the levers and treadles, when the tappets are fixed at the side of the loom; fig 118 shows a loom provided with side tappets, the term "cross rod" or "Yorkshire loom" is generally given to this arrangement; the bottom shaft is extended on the off side, and serves as a convenient stud on which the tappets work. The proper rate of speed for driving the tappet is obtained by changing the pinion wheel fixed to the crank shaft, then introducing a carrier wheel between the crank pinion and tappet wheel to enable the two wheels to gear; with a constant tappet wheel of 120 teeth, a 60 pinion will give 2 picks to the round; a 40 pinion 3 picks; a 30 pinion 4 picks; 24 pinion 5 picks; a 20 pinion 6 picks; if 7 picks to the round is required with a 120 tappet wheel, 7 does not divide exactly into 120, therefore two intermediate wheels must be used in place of the carrier wheel, fig 119 illustrates the arrangement A crank pinion B and C intermediate wheels, D tappet wheel, assuming a crank wheel of 20 teeth, 7 times 20 = 140 will give the intermediate driven B, and 120 the number of teeth in the tappet wheel will give the intermediate driver C, or any ratio of these two numbers, say 28 and 24, obtained by dividing both 140 and 120 by 5. The most useful rule made as set forth in "Calculations in Cotton Weaving", is to split the train of wheels up into driving and drivers, then if a driver is missing divide by the drivers; if a driven is missing divide by the drivers.

Sometimes the tappets are fixed under the loom as illustrated in fig 120 assuming that the following wheels are used crank wheel A 40 teeth, bottom shaft wheel B 80 teeth, what other wheels must be used to give 5 picks to the round; picks to the round multiplied by driver will give the driven



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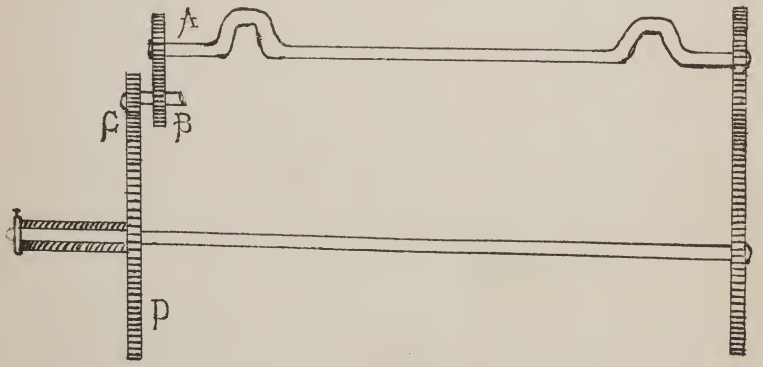

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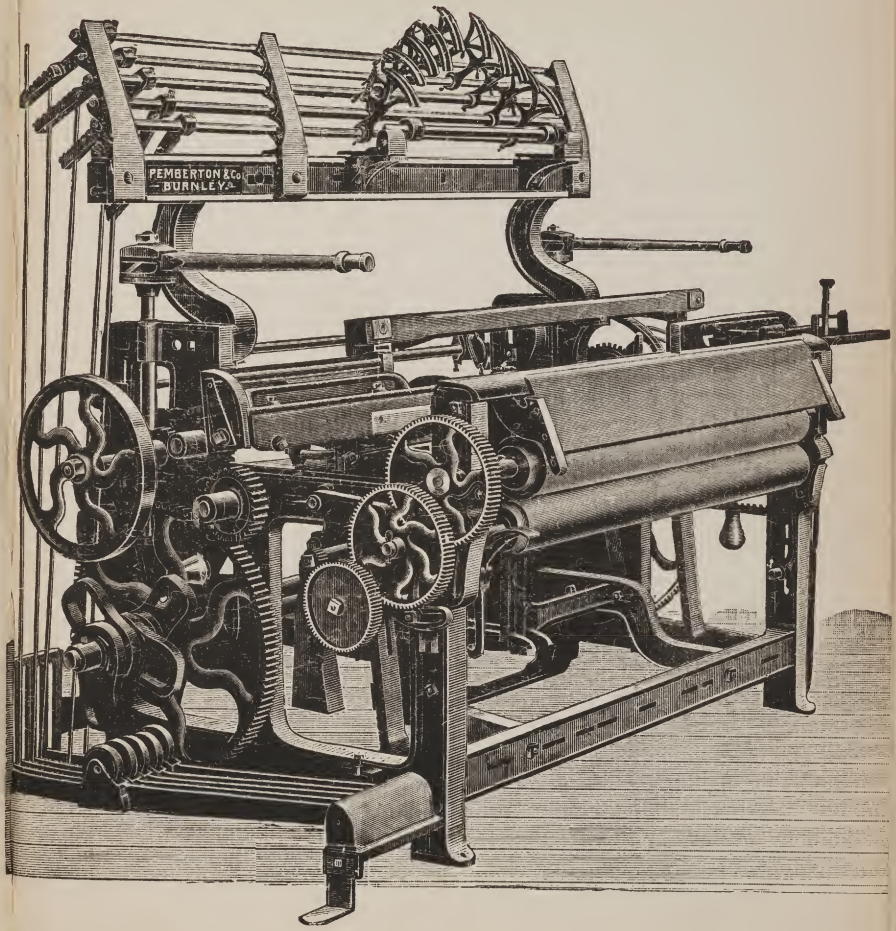
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the driven wheel 80 will give the driver required: Therefore the two wheels are 5 × 40 = 200 driven 80 driver or any ratio of these two numbers, dividing both numbers by 5 gives 40 driven 16 driver. With a constant wheel F of 60 teeth what other wheels must be used to give 3, 4, and 5 picks to the round.

A few examples will now be taken –

(1) with a 15 crank wheel and 100 tappet wheel, what intermediate wheels would you use for 16 picks to the round

(2) What is the speed of the tappet when using the following wheels – crank 48. bottom shaft 96, pinion 16 driving tappet shaft wheel 40.

(3) Side tappets, with a 35 crank pinion, 90 tappet wheel what other wheels must be used to give 6 picks to the round.

(4) Leaving out the crank pinion in the 93. other wheels and picks to the round remains the same, find teeth in crank pinion

(5) What will be the relative strain on two warps, loom A makes a 2" shed, loom B a 3" shed, the speed is the same in both.

In the above example the strain varies as the square of the space passed through. A loom $2^2 = 4$ strain B loom $3^2 = 9$ strain.

(6) In 90 assuming A runs 120 picks and B 100 picks per minute, the size of the sheds as before, find relative strain.

(7) In a loom C, the weft is ⅓ of a pick in loom D ⅔ of a pick find the relative strain on the two warps

(8) In a plain loom the sweep of the slay is 5", the distance of the heads from the fell of the cloth 9", the length of the treadle from the heald to point where heads are attached 22", the treadle bowl is 16" from the heel size of shuttle 2" wide by 1½" deep, allow ¼" for clearance find the stroke of the tappet.

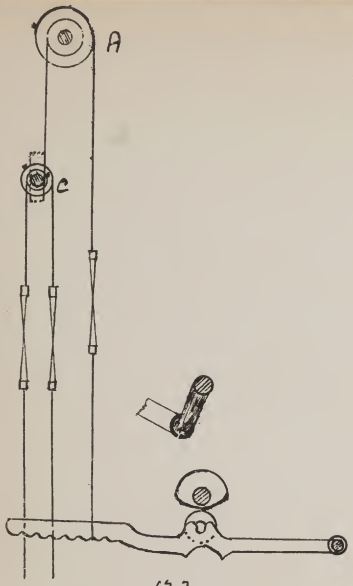
(9) In a loom with side tappets the particulars are, sweep of slay 6", from heads to fell of cloth 15", length of top lever to that side where the heads are attached 6" on the other side 7" length of treadle from heel to point where heads are attached 32" from treadle bowl to heel 20", find the stroke of the tappet

James Holmes Jr. & Sons Burnley

Shedding (Tappets)

When tappets are placed under the loom, as in the making of a piece of plain cloth fig 121, the two healds are connected at the top to straps, which pass part way round and are fixed to a roller carrying 2 pegs, the straps from the back heald is fixed to the larger bowl, the strap from the front heald to the smaller bowl. Theoretically both bowls are the same size, but practically the bowl working the back heald is larger, to enable the same size of shed to be made by both healds at a point in front of the shuttle, for the same reason the leaf working the back heald is about ¼" larger than the other, this form of tappet is termed a negative one, because it can act in one direction only, namely to push down an heald, but by the arrangement of top rollers given, the sinking of one heald, causes the top roller to turn round and lift up the other heald.

Tappets up to about 5 picks to the round, are placed under the loom with top roller arrangements to enable a sinking heald to bring up a rising one; fig 122 shows the arrangement, for working three healds, making a 3 end twill 2 down 1 up on each pick, these cloths pass under the names of Jeans, Jeanettes, Drills, & Pulletties. the top rollers on this and the others to follow are worked on the lever principle, A is a roller in a fixed bearing, the diameters of the two bowls are in a ratio of 2 to 1, the larger bowl working the back heald; fixed to smaller bowl is a strap which supports the swing roller C, the bowls on which bear a ratio of 1 to 1 [a swing roller is not in a fixed bearing, it is free to move up and down a slot or groove provided for it, and when required, to turn part way round at the same time; the working of the rollers will be best understood by treating the bowls as levers fig 123 say the 1st heald is lifted 3" by the 3rd heald going down 3" the 2nd heald remaining stationary, as the 3rd heald goes down 3" the end of lever A goes down



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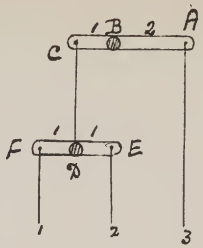

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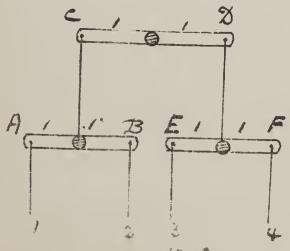

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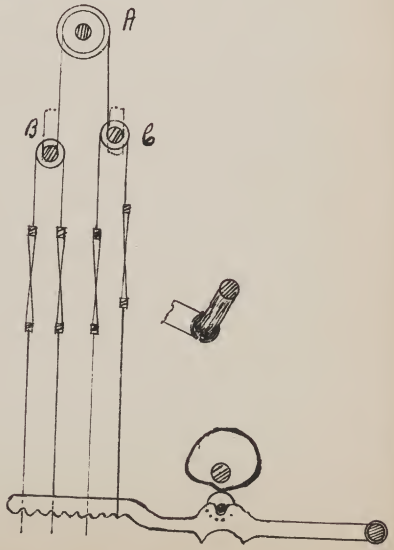

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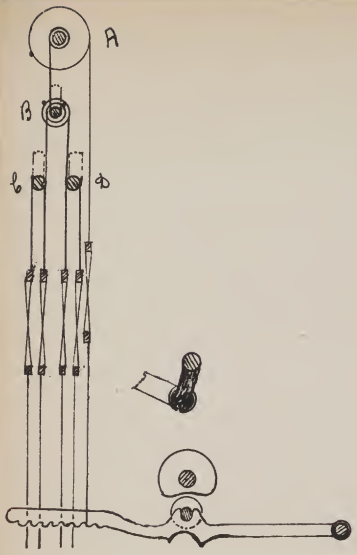

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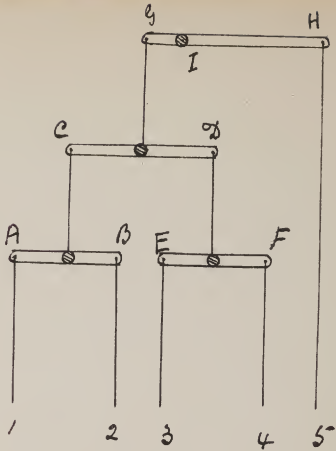

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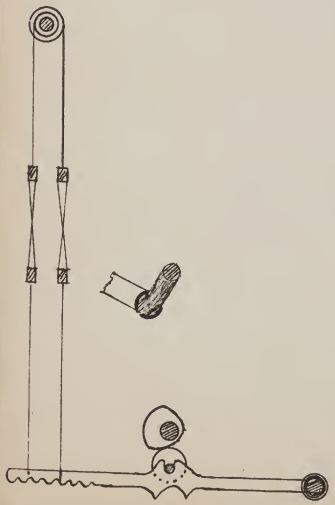
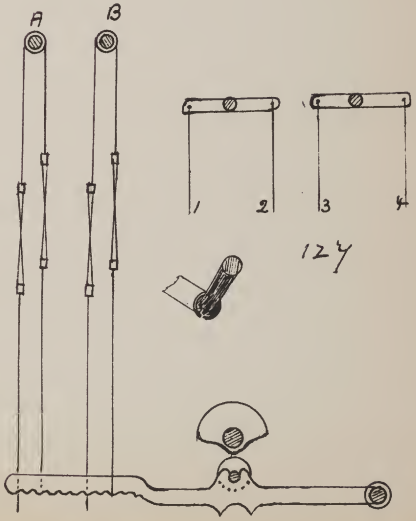




127

3", B goes up 1½", the lever F.D.E the end E being connected 25° to the stationary heald becomes the fulcrum of the lever, the middle of the lever D is taken up 1½: the free end F 3" lifting the front heald that amount.

Fig 124 illustrates the 3 and 1 twill, 3 down 1 up on each pick, A is a roller in a fixed bearing, B and C swing rollers: fig 125 shows the rollers treated as levers, the numbers indicate the lengths of the respective arms: say the 1st and 4th healds change their positions, the 1st goes down 3" the 4th goes up 3", as the 1st goes down 3" so does the end of lever A, the middle of the lever goes down 1½" bringing down the end of lever C 1½ the end D goes up 1½ lifting the middle of lever E F the same amount, causing F to come up 3" lifting the 4th heald that amount.

Fig 126 illustrates the 4 end twill, 2 up 2 down on each pick: two rollers A and B are in fixed bearings, both healds from the same roller are never lifted or lowered at the same time, in the fig the 1st and 3rd are down the 2nd & 4th up, treated as levers the arrangement is given in fig 127 these cloth pass under the name of double twills, Cashmere twills, shallow twills, and 2 & 2 twills

Fig 128 illustrates the 5 end twill or satin (Sateen) 4 down 1 up on each pick, A is a roller in a fixed bearing, B, C, and D, swing rollers, treated as levers the arrangement is shown in fig 129 allowing the 1st and 5th heald to change their positions the 1st to go down 3" the 5th to go up the same amount, 2, 3, & 4 Stationary; A comes down 3" middle of lever 1½" bringing down C 1½, the middle of lever C D comes down ¾" bringing down D ¾" working on the fulcrum I H goes up 3" taking up the back heald that amount

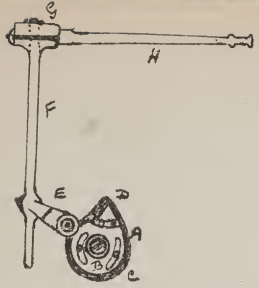
James Holmes Pres Examiner

Picking (overpick & Underpick)

Picking takes the character of a blow, throwing the shuttle from box to box in the fractional part of a second: it is no easy matter to calculate exactly the amount of force required for this purpose. Two methods of picking are in common use, namely overpick illustrated in the loom fig 130; Underpick shown in the loom fig 131.

The overpick is the most extensively adopted for plain fast running looms; Fig 132 illustrates the parts of the motion; fixed to the bottom shaft B are two picking plates b, one on each side of the loom, they are made up of the boss, which is keyed to the shaft, and the shell A, which is fixed by means of bolts to the boss, this allows the position of the shell to be altered so as to pick sooner or later, the nose-bit D, which is bolted to the shell, fixed to the side of the loom is the upright picking shaft F, projecting from it and resting in contact with the picking tappet, is the short lever E termed the picking bowl, on the top of the picking shaft is a box G, made up of two parts, the surfaces which are in contact are furrowed; the top part holds the picking stick H, the whole is then firmly secured with a large bolt, the furrowed surfaces preventing the position of the picking stick from altering by the repeated blows given to the shuttle; at the free end of the picking stick, is fixed the picking band, which in its turn is fixed to the picker, the picker slides freely on the spindle in the shuttle box; as the bottom shaft revolves, the nose bit D. strikes the picking bowl E. turns the picking shaft part way round, moves the picking stick towards the inside of the loom and throws the shuttle.

The shedding and picking are timed to suit each other, but it will generally be found that the shed will be sufficiently open to allow the picking to commence, just as the crank goes on the bottom, in broad looms weaving narrow cloth pick a little sooner, and in cases where the cloth is full up in the reed pick a little later



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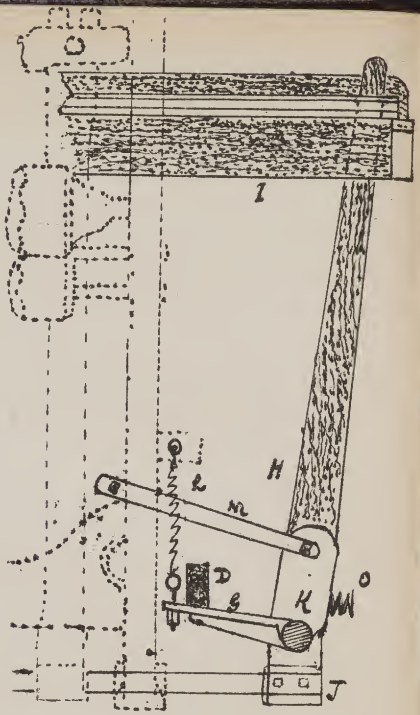

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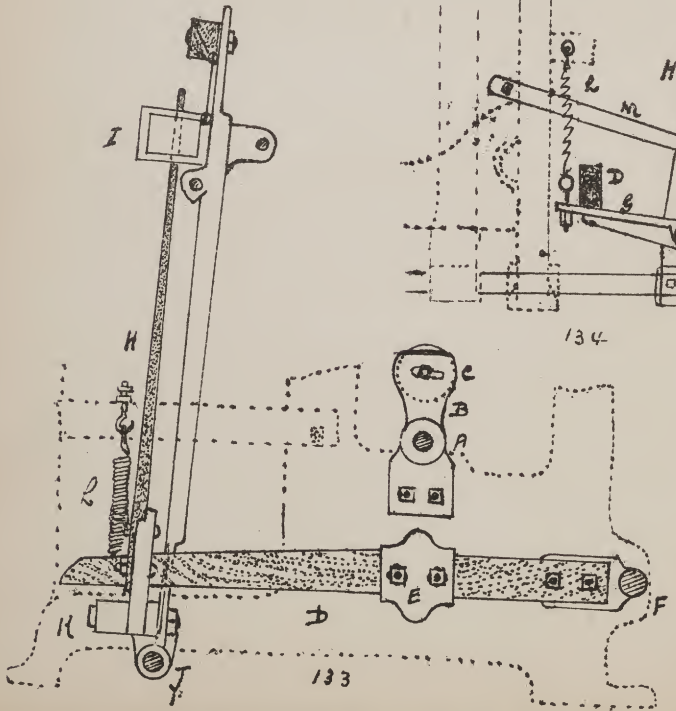

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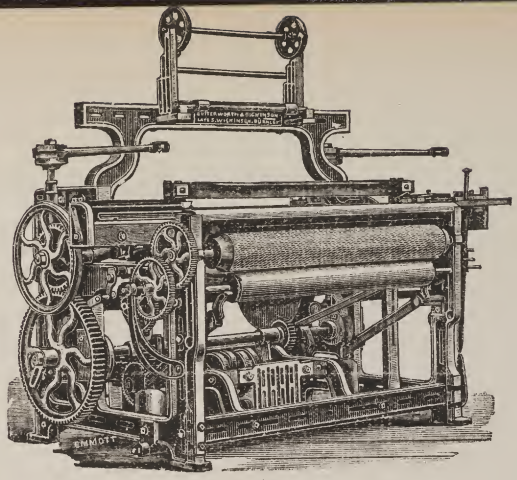

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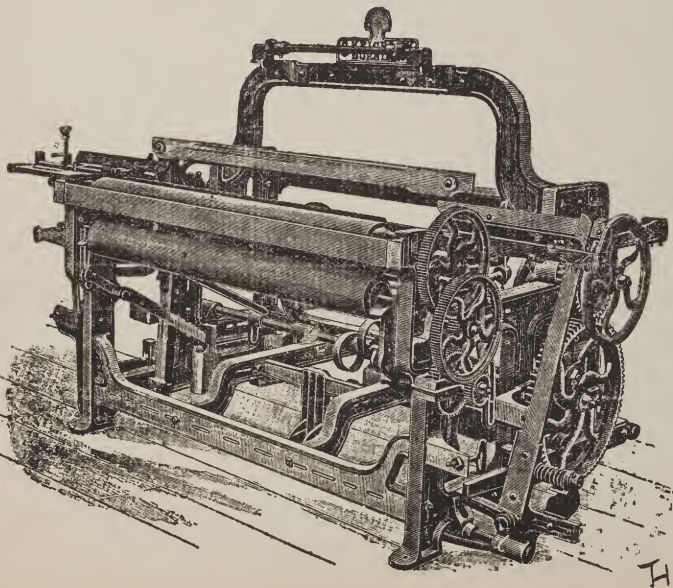

131

The following brief notes in respect to picking will be found useful.
The shuttle must be level with the reed and box back.
The reed and box back must be in the same straight line.
The box plates must be on a line with the shuttle race, the box a little more open at the front than the back; the picking bowl must rest in contact with none but all the way across when picking takes place
Underpick, the arrangement is shown in detail in figs 133 side view and fig 134 front view, the dotted outlines show part of the frame work of the loom. In fig 133, A is the end of the bottom shaft to which is fixed a short arm B, to the end of this is fixed a bowl b, D is a wood lever shod with iron at E, the fulcrum of D is F, the free end of D, passes over and rests in contact with a short lever G at the foot of the picking stick H, seen much better in fig 134, the picking stick H passes up through the shuttle box I, the lower part of H is fixed to J which forms part of the rocking rail of the loom, H being free to move on the fulcrum K fig 134, G is held up by the spring L, M a short strap attached to the picking stick, the other end is fixed to the slay sword, this prevents the former from going too far against the box end, slid on to the top of the free end of the picking stick is a picker inside the box I at the other side of the loom is a similar arrangement except the bowl b is fixed to the bottom shaft wheel, this is well seen in fig 131. Its action is this, for every revolution of the bottom shaft bowl b strikes D forcing it down, this motion is communicated to G (fig 133; fig 134) the picking stick working on the fulcrum K moves towards the inside of the loom and throws the shuttle, the spring L comes into play lifts up G, turning the picking stick back to the end of the box, and the lever D to its former position. It is used for light muslins, and fine linen goods, being much cleaner in its action than the overpick. Spring D prevents rebound of the shuttle

James Holmes M.I.A. Burnley

The slay is slightly hollow in the middle, and rounded in the centre, so the reed is thrown a little further back in the centre than it is at either end.

The reed as before stated is fixed to the slay it guides the shuttle, and seperates the warp ends, it consists of pieces of flat wire arranged side by side, the ends being secured to pieces of Wood (reed bands) by the liberal use of band and pitch. the flat wires are termed seperately dents, and the number of dents per inch in the reed, regulates the number of ends per inch in the woven cloth; in the making of the reed the number of dents per inch can be regulated, so that a reed may be made with 20 dents per inch. 30 dents per inch and so on, the thickness of the wire used diminishing with the increasing number of threads per inch. Ordinary cotton cloths are generally made with 2 ends in one dent. but in fine cloths say 120 or 140 threads per inch weaving 50's twist, 3 ends in a dent may be used using of course a corresponding coarser reed.

The System of reed counting generally adopted on the "Manchester Exchange" is termed the Stockport Counts, it is based on the number of dents on 2 inches, thus a 60 reed contains 60 dents on 2 inches, with two ends in one dent, 120 threads on 2 inches or 60 threads per inch.

Other systems of reed counting are —

Bolton — based on the number of "leers on 24¼", a leer consists of 20 dents. Two Scotch Systems one is based on the number of hundreth splits on 37", the other the number of porters on 37", A porter equals 20 dents.

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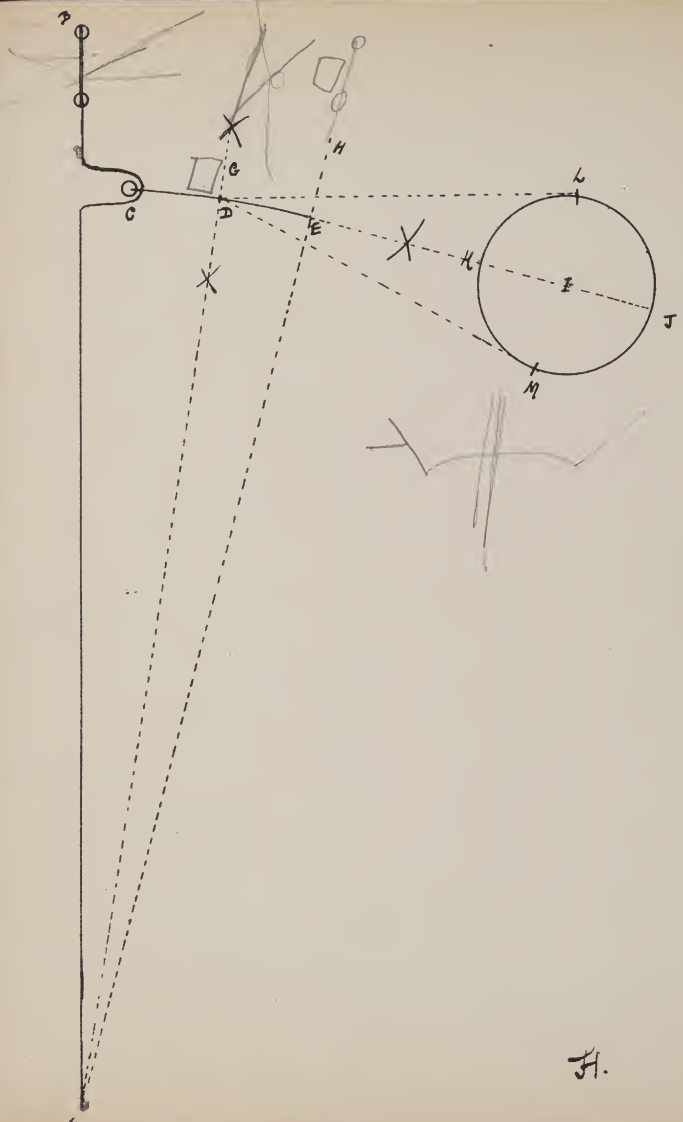


H.

Beating Up.

The reed serves the double purpose of guiding the shuttle, and beating up the weft, this last operation is termed "Beating up". The slay to which the reed is fixed is not uniform in its motion, it moves quickly when beating up takes place, and slower when the reed is away from the fell of the cloth, and the shuttle travelling from box to box, this variation in speed is for the purpose of giving time for the shuttle to move across the loom, whilst the bottom shed is in contact with the shuttle race, and as the slay moves quicker when beating up, the extra speed gives additional force to beat up the weft.

Fig gives a graphic illustration of the movement of the slay during one complete revolution of the crank.

The particulars are taken from a 36" reed space loom weaving 16 to 26 pick cloths, running 220 picks per minute.

Length of slay sword from fulcrum to pin 6 26", Sweep of crank 5", length of crank arm 10".

Let FB be the position of the slay sword when the reed B is to the fell of the cloth, with the compass point at F describe the line CDE, which equals a line described by the slay when moving away from the fell of the cloth, CDE equals 5". The dotted line FG represents the position of the slay, when half way between the fell of the cloth and its furthest extremity from it, FG also divides CDE into 2 equal parts; FH gives the position of the slay when at its extreme distance from the fell of the cloth; on the line FH from the point E draw the line EKIJ at right angles to FH, somewhere on the line EKIJ will be the centre of the crank shaft; take a distance of 4½" between the compass points, which equals the length of the crank arm 10" less 2½" the crank, with one point of the compass at E, EKIJ will be cut at I, I therefore is the centre of the

crank shaft. with I as the centre describe the circle L K. M. J. with a radius of 2½". To prove by means of this diagram that the motion of the slay is eccentric, it is assumed that the motion of the crank is uniform; the line C D E is divided into 2 equal parts, at the point D; take a distance of 10" equal the length of the crank arm between the compass points, with one leg at D the other will cut the circle at L, again with one leg at C, the circle will be cut at K, again with one leg at C the other will cut circle at M. when the beating up takes place the slay moves over the space D C. and back again C D, and when the slay is at its furthest extremety from the fell of the cloth, it moves from C to E and back again from E to C, during this time the crank moves through the space M. J. L. the motion of the crank is uniform; it will move through space L K M. (Reed beating up the weft to the fell of the cloth) in less time than it will move through the space M. J. L (shuttle travelling across the loom), on account of the space being shorter; and on that account the reed will move quicker when nearer the front, and slower when further away.

The following conditions tend to increase the amount of eccentric motion in the slay—:

Shorter the crank arm, long ears are sometimes cast on the slay sword for this purpose.

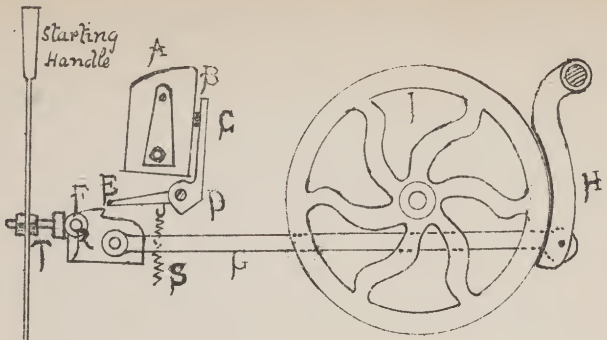
Greater the sweep or throw of the crank.

The slay swords are perpendicular when the reed is to the fell of the cloth; at other times but in rare cases, the slay sword moves over the centre of oscillation, the slay swords are then not perpendicular with the reed to the fell of the cloth

Stop Rod. Loose Reed. West fork motion. Taking up Motion

Stop Rod when the shuttle stops in the shed on account of the picking band breaking or through any other cause, some provision must be made to prevent the ends from being broken, two methods are in common use namely stop rod, and loose reed arrangement. Fig 136 illustrates the stop rod motion. A, box end; B. swell; C finger attached to the rod D which extends from one side of the loom to the other; E stop rod tongue; F frog; G a bar extending from the frog to the back brake H; I brake wheel; J a spring to keep tongue pulled down, R a small projection from the frog it rests in close contact with a short stud T fixed to starting handle; the frog is fixed to the loom side and is free to slide along it for about half an inch, its action is this— every time the shuttle enters the box at the proper time ~~the~~ it pushes back the swell B, and consequently the finger C, the tension of the spring J is overcome and the tongue E raised clear of the frog. The loom continues its motion, but if the shuttle is caught in the shed or fails to reach the box at the proper time, the tongue is not lifted, but comes in contact with the frog which slides a short distance bringing the back brake H into action, a short stud R fixed to the frog comes into contact with T knocking the starting handle out of position and the loom stops

Loose Reed, in this motion the reed gives way in event the shuttle is caught in the shed, fig 137 shows the arrangement as seen from the off side of the loom, fig 138 as seen from the starting side. The same letters refer to the same parts; A. slay cap to hold reed; B reed. C, slay D a bar of wood & iron to hold reed in position, F a



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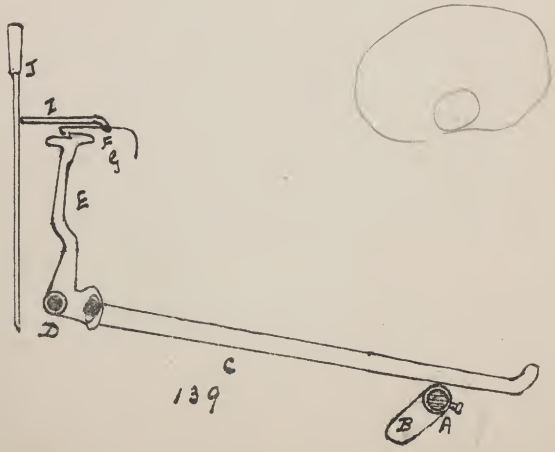
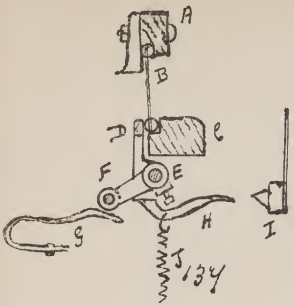


139


A
B
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D
E
F
G
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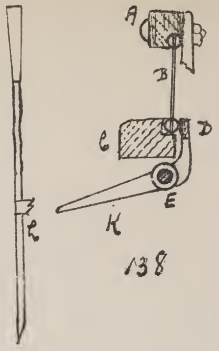
I
J

134


A
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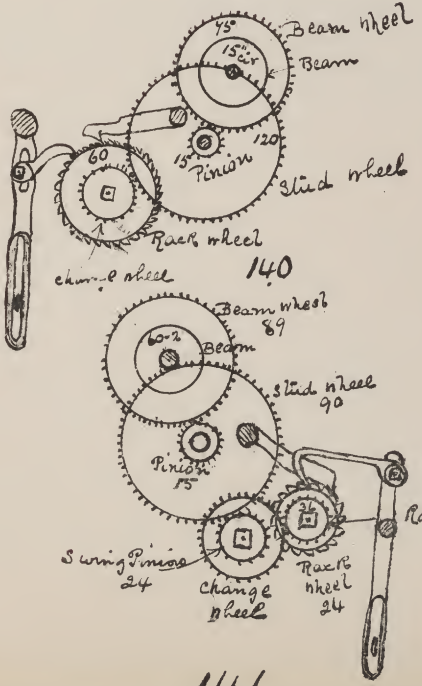
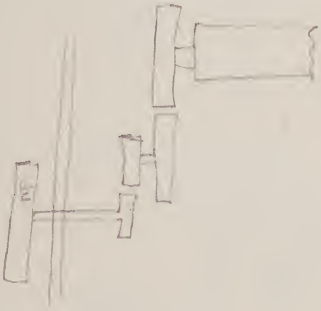
K

138


75
Beam wheel
15 Cir
Beam
120
15
Pinion
60
Stud wheel
Rack wheel
change wheel
140
Beam wheel
89
60-2
Beam
Stud wheel
90
Pinion
15
24
Rack stud wheel. 36
Swing Pinion
24
Change
wheel
Rack
wheel
24

141



roller which runs on a bent spring when the slay is thrown back; H a short lever the end of which passes beneath the heald I when beating up takes place, E is a fulcrum on which the levers, of which D, F H and K form part work: its action is this when the slay is thrown back the roller F passes on to the bent spring G, and the reed by this means is held firm, at the time the shuttle is passing from one box to another, when the beating up takes place the end of H passed under I and keeps the reed firm; if the shuttle is caught in the shed the reed gives way, there being nothing to prevent it only the weak spring J (which the pressure of the shuttle against the reed easily overcomes) forcing back D, the free end of H passes over the heald I and the reed is perfectly free, at the same time the lever K is lifted and the end coming in contact with the slashing handle the loom stops

Weft Fork Motion, when the weft breaks there must be some means of stopping the loom otherwise a lot of time would be wasted, and the arrangement shown in fig 139 is one of the simplest and most ingenious part of the loom A is the bottom shaft of the loom. B a small tappet. C E form a lever working on the fulcrum D. Resting on E is the fork G with its fulcrum at F, each pick the fork is lifted up by the weft just at the moment tappet B comes into action, if weft is absent the fork does not move the notch in the top of E comes in contact with the catch in fork G, pulls it forward & stops the loom.

Taking up Motions. Old Motion shown in 140 to obtain the dividend.

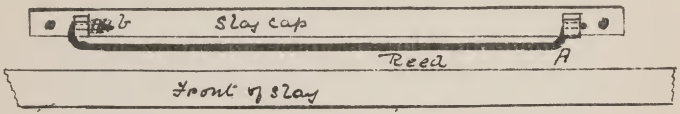
$$\frac{\text{Rack W} \times \text{Beam W} \times \text{Stud W}}{\text{Cir of Beam in } \tfrac{1}{4}\text{"} \times \text{Pinion}} = \text{Dividend}$$

then add 1½ % for contraction. Fig 141 Pickles Motion

$$\frac{\text{cir of Beam in } \tfrac{1}{4}\text{"} \times \text{Pinion} \times \text{Swing pinion} \times \text{Rack Stud wheel}}{\text{Beam wheel} \times \text{Stud wheel} \times \text{Rack wheel}} = \text{Dividend}$$

add 1½ %

Shuttle Guards. are contrivances fixed to the slay cap for the purpose of preventing the shuttle from leaving the loom, if through any cause it should leave its usual track; in view of the recent decisions in the law courts, it is now required that all looms must be provided with a shuttle guard; one of the oldest forms though slightly altered is shown in fig 142 143



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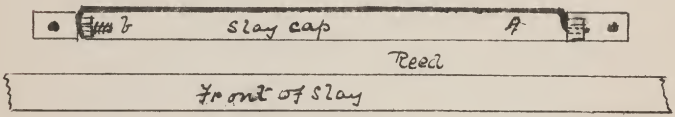

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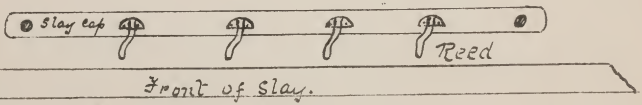
It consists of a piece of bent iron A which when in action projects beyond the reed, and over the track of the shuttle, it is held at each end by brackets secured to the slay cap, on of the brackets has on the outside a vertical groove into which the bent rod is pulled by the spring b when in a working position, when taking ends up the rod is pushed back into contact with the upper part of the slay cap fig 143 when the loom is set in motion the slight blow given by the reed in beating up, brings it back to its working position Another simple guard is shown in fig 144



144

Fixed to the slay cap at intervals of about 6" are small wire brackets which overhang the shuttle race; they are easily fixed by means of two small screws.

Some common faults in looms.

Loom Bowing: of. Broken sticks; picking too hard or too weak, swell spring too tight or too slack; picking band too tight or too slack; box side loose; too much play for the shuttle in the box; picking too soon or too late; badly worn swells, rod or badly worn shuttles; slay sword or rocking rail coming loose; [illegible] in picking stick or picking band also the following: worn or picking stick or picking band also the following; parts wearing or coming loose, spindle steel; box end; cheek strap; picking band; picking tappet; nose-bit; picking stick; spindle; picking shaft and footstep for the same; crank or bottom shaft wheel; frog; slip rod tongue; or slip rod brackets; slot rod finger; swell; swell pin or brackets.

Shuttle flying out and turning over. Any of the causes which bring about the banging of the loom, in addition the following: Cracked spindles. The reed overfacing with the box back, box pegs and shuttle race not being in the same straight line; sides and box backs not being in proper level with the shuttle; cracked dents or a very uneven reed; sometimes a new picker, or the shuttle binding in the box.

Bad Selvedge. It is generally the selvedge on the contrary side to the weft fork which is bad: it may be due to the following - ends taken up wrong; picking too weak from that side, or too strong from the opposite side; set the temple near to the reed, let the sheds be clear and bottom fairly well; set the tappets a little later and pick a trifle sooner his enables the weft to get well in before the shed closes.

Cover. In cloths woven with fine reeds and many picks there is little trouble, in coarse reeds and few picks very little can be obtained, when most is expected - to cover the poorer character of the cloth; first no the back rest or lower the heddle, pull back the loose rods, this allows the top shed to be slack so that the warp threads spread and fill in the interstices caused by the dents of the reed or third the tappets a little sooner. a soft spun weft will improve the cloth and give cover.

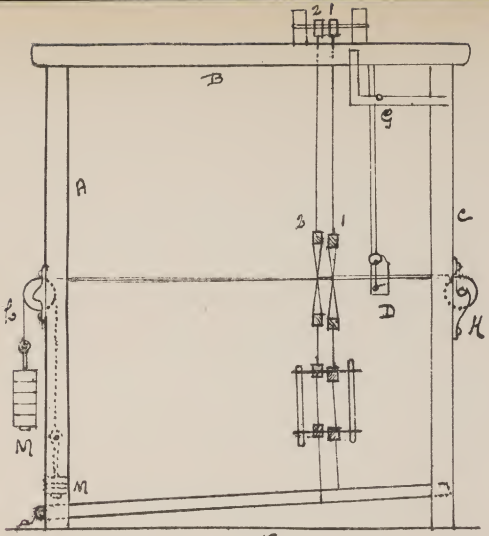
Uneven Cloth may bring about the appearance of a piece of cloth to much as unevenness, this may be due in Dobbie and Jacquard to the pattern not being well balanced, and in twills in certain systems of the sleleting, or it may be due as in plain cloth to one of the following causes. Uneven weft: Beam weights touching the floor, chains or ropes binding and not allowing the yarn to slip freely; beam edges loose, crooked or loose beam pitles; back rest resting on the beam flanges; crank arm loose or too much play; rocking rail footstep loose, bad shedding; putting up motion working irregular or any of the catches or wheels coming loose, if the finger at the weft fork lever lift both catches when the same is pulled back in setting the loom on, it will make shiny places in the cloth.

Weaving without weft and making Thin places

weft not touching the pick; or the hammer does not pull the fork far enough to clear the setting on candle is be pulled out of the notch in the framework of the loom; finger loose, soft weft;

The looms are still much used in the silk trade in Switzerland and formerly largely in Macclesfield in this country. They are extensively used in India in the making of fine muslins. for experimental work and pattern weaving they are preferable to the power loom, as changes can easily be made from one pattern to another. handlooms fit up with healds are worked by treadles by the weaver, some looms are provided with small dobbies, and others by far the most useful are fit up with Jacquards.

Fig 145 & 146 give sketches of the simplest form of hand loom fig 145 gives a side elevation and fig 146 a front elevation, A. B. C. gives the framing made of wood, the slay D is is slung from two short brackets E fixed to the framing the cloth roller K is placed in front the warp beam R behind the latter is weighted by the weights M at the top of the framing are two wood levers 1 and 2 fig 146 these are connected by cords N to the levers 1 and 2 at the outside of the frame in fig 146 these levers in their turn are connected to the two treadles beneath the loom. the levers 1 and 2 are connected to shorter levers and these in their turn are attached to the healds. the numbers throughout in fig 146 indicate to which levers and treadles the healds are attached, for example no 2 treadle is pulls down long lever 2 this in its turn is attached to 2 lever at the top of the loom and lifts no 2 heald. but no 2 treadle is connected through the short lever 2 beneath the healds to no 1 heald, so that the downward movement of no 2 treadle lifts no 2 heald and pulls down no 1, in like manner no 1 treadle lifts no 1 heald and pulls down no 2. The shuttle is thrown by pickers which are connected to strings or cords the free ends of the cords are attached to a short handle in the centre of the loom. the weaver holds this handle in one hand and moves it quickly from side to side and throws the shuttle, the beating up is done by the weaver pulling the slay forward on each pick. the weighting and taking forward the cloth is all done seperately by the weaver.



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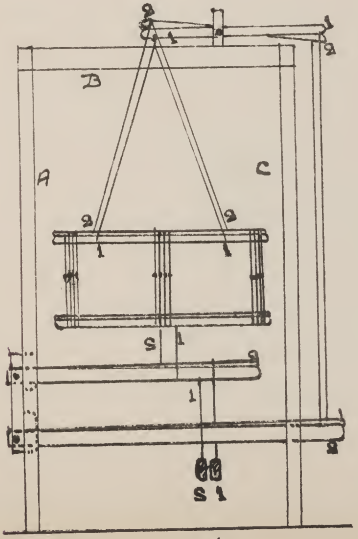

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Examination Paper – Yarn Calculations –

(1) What will be the resultant counts obtained by twisting 20s and 40s together?

(2) What will be the resultant counts obtained by twisting 20s 30s and 40s together?

(3) 20s yarn at 6d per ℔ is twisted with 30s at 9d per ℔ allowing 1d per ℔ for the doubling what is the value of the doubled yarn per ℔.

(4) What is the value of a 3 fold yarn per ℔ obtained by twisting 20s at 6d 30s at 9d and 40s at 10d per ℔ allow 1½d per ℔ for doubling.

(5) If 4 cops are unwrapped 1 lea from each, the total weight is 156 grains what is the counts.

(6) You take 120 yards of weft it weighs 10 grains what is the counts.

(7) How do you find the weight of 1 lea of yarn say 25s counts

(8) You take 25 yards of weft from a piece of cloth you find it weighs 3½ grains what is the counts.

(9) You have a piece of cloth a yard wide, and 56 grains of 50s weft, how many picks will it give in the piece

(10) What will be the weight in grains of 5·26½ yds of 56s weft.

Rules for folded yarns. Find the weight of 1 lea of each, divide the total weight into 1000.

To find Counts, Weight or Length.

Yards } multiplied together
840 } multiplied together
Counts
Weight

Equals

If any factor is missing divide by that one to which it belongs

Examination Paper - The Loom -

(1) Draw a tappet for a 5 end sateen, state suitable dimensions and dwell. tappet under the loom, 4 down 1 up.

(2) State what measurements and other particulars you would require before you proceed to draw to scale a pair of Shedding tappets for plain cloth.

(3) Draw a Keighley dobby or any other you are acquainted with explain fully all the parts.

(4) Sketch the overpick arrangement and explain its action, state the class of cloths used for

(5) Sketch an ordinary Underpick motion, explain its action by means of your sketch; state the class of cloths woven.

(6) Describe the weft fork stop motion, and say how it should be timed. Give sketch

(7) Sketch the Stop Rod arrangement and explain its action.

(8) Sketch the Loose Reed motion, explain its action.

(9) Give the Top roller arrangement for five end sateen tappets under the loom, explain how it works

(10) Give a range of cloths which are commonly woven by tappets

(11) What are the uses of temples in a loom.

(12) What purposes does the lease rods serve.

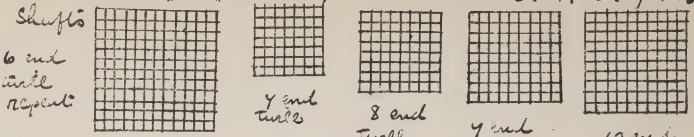
(13) Give a sketch of 1st the old positive taking up motion 2nd Pickles's taking up motion, state the principle difference between them.

(14) Prove by means of drawings that the motion of the sley is eccentric.

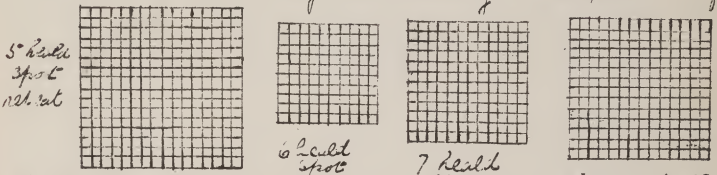
(15) Construct a plain tappet to scale to the following particulars, nearest point of contact 1" treadle bowl $2\frac{1}{2}$" dia. stroke 2" dwell $\frac{1}{3}$ of a pick

Examination Paper – Designing

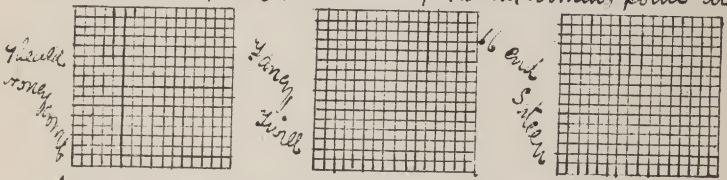
Give a range of twill patterns on 6. 7. 8. 9 & 10 Shafts



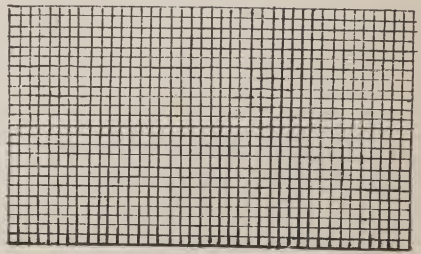
Make a number of small spot figures on 5. 6. 7 and 8 Staves assuming the looming to be point draft



Make an honey comb pattern on 4 healds, looming point draft



Make a fancy twill using 16 healds. Make a 16 end sateen. Make the design looming and pegging plan for the sample cloth supplied



Examination Paper - Loom Calculations -

(1) What size of pulley will you require on a loom to give 168 picks per min. if the driving drum is 14" on a shaft running 108 rev. Draw the taking up motion you are accustomed to, and give the

(2) train of wheels required to weave 112 picks per inch of cloth. circumference of taking up roller 14 inches.

(3) A tappet has 180 teeth on and runs 14 picks to the round, there is a 15 pinion on the loom shaft. Give the required intermediate wheels

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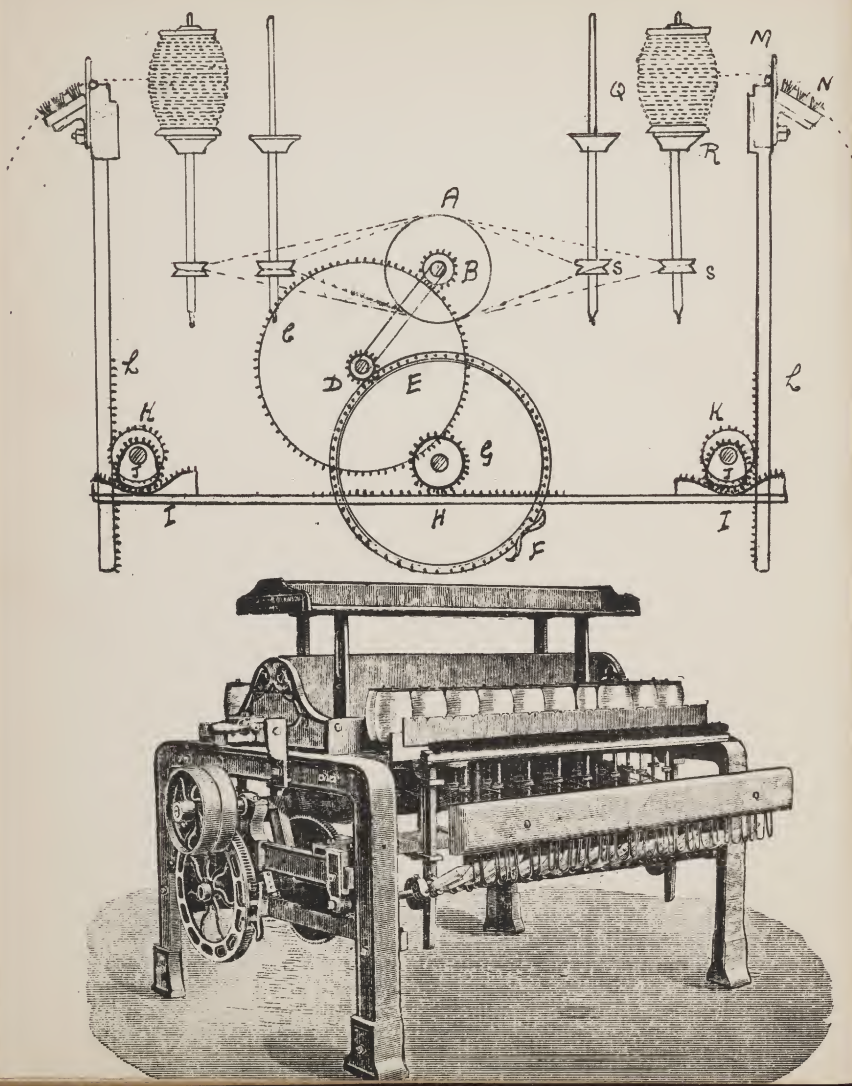
(4) What lift should a tappet have to make a plain cloth. the other arrangements in the loom being as follows - Sweep of lay 5½"; distance of healds from fell of cloth 8"; length of treadle 24"; distance of heel of treadle to centre of treadle bowl 16", size of shuttle 1½" broad by ¼" deep. allow ¼" for clearance.

(5) For a side tappet loom give the length of the top lever at each side of fulcrum. the other particulars being - Lift of tappet 2½" from heel of treadle to tappet bowl 20", total length of treadle 30" shuttle 2" wide 1½" deep; sweep of lay 6"; the front of healds 9" from the fell of the cloth. allow ½" for clearance

(6) Where the tappets are fixed under the loom give the train of wheels required (sketch) to make 3 end twill, 4 end twill 5 end sateen.

(7) Explain the difference between Pickles's taking up motion and the one of an older style. For the latter kind what circumference of emery beam will be required to put in 21.75 picks per quarter inch the train of wheels being as follows - Beam wheel 75, rack wheel 48 Shaft wheel 120, little pinion 15 change wheel 24.

(8) Find the stroke of the tappet in a cam rod loom the other particulars are - Sweep 5" from fell of cloth to healds 9" length of arms on top lever 5½" on the side to which healds are attached 6½" on the other side. length of treadle 32" from treadle bowl to treadle heel 22" shuttle 1½" broad by ⅛" deep. allow ⅛" clearance.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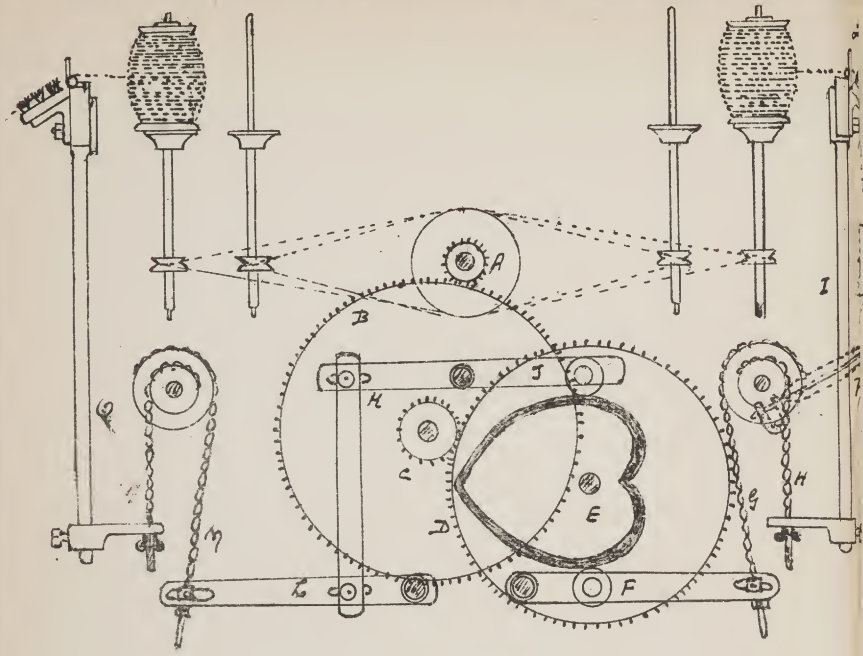
Cop Winding Machine

In a weaving concern the winding of the yarn from the cop on to the winders bobbins is the first process, the machine used is the winding frame illustrated in figs. 1. 2 and 3. Fig. 2 gives a general view of the machine figs 1 and 3 showing more details:
The principle parts of the machine are shown in fig 1, it consists of framing with a central tin roller A, extending the whole length of the frame: on each side are two rows of spindles driven by means of bands from the central tin roller A; a few inches above the wharves around which the band passes is a braid R on which the bobbin Q rests, the cops are placed on skewers P (fig 3) the end passes over the knee board 6. (fig 3) covered with flannel thence through a brush N, and a guide plate M on to the bobbin, the brush and guide plate form a traverse guiding the yarn on to the bobbins, from the bottom to the top, and from the top to the bobbins. The traverse motion is worked from the tin roller shaft by means of a train of wheels; a small pinion B is fixed on the end of tin roller shaft (fig 1) it drives C, on the same stud as C is a small pinion D which gears with and carries round the mangle wheel E, when the opening F of the mangle wheel comes opposite to the little pinion, the latter slips inside the mangle wheel and reverses its direction of motion, so that it goes once round in the direction from right to left then once round from left to right, on the same stud as the mangle wheel is a pinion



racks are semicircular racks I which gear with eccentric wheels J, on the same stud in an ordinary wheel K or circular motion, gearing with the upright rack L having at the top the brush and guide plate which form the traverse; it has been stated that the mangle wheel goes first in one direction and then the other, the small pinion G which gears with the racks H, will therefore cause the rack to move, first to the right and then to the left, the semicircular racks I act on the eccentric wheels causing them to make part of a revolution in one direction then part of a revolution in the

opposite direction, the wheel K has the same motion, and as it is in gear with upright rack L it causes it to rise and fall; the traverse does not move at an uniform rate from the bottom to the top, but moves quicker towards the top and bottom and slowest at the middle, so that more yarn is wound on to the bobbin at the middle than at either end, the full bobbin then assumes a barrel shape; this is brought about by the semicircular rack and eccentric wheels, where the hollow part of the rack drives the largest part of the wheel. it drives it at its slowest speed, and the yarn is at that time being wound on to the middle portion of the bobbin; but when the larger part of the rack drives the small part of the wheel the traverse is driven at its quickest speed, this occurs at the top and bottom of the bobbin. Another traverse motion in common use is the heart motion illustrated in fig 3. A drives B. C (is on same stud B) drives D, on the same stud as D is a heart cam E when the full side is at the bottom it pushes down F, and through the chains G & H lifts up the traverse I as the cam revolves I falls with its own weight; when the full side of the tappet is at the top it lifts up J, lowering K likewise L and through the chains M. N raises the traverse O

Some of the faults of bobbins are soft at the ends caused by a faulty traverse, too many big knots, or snarles.

Drum Winding

Where coloured yarns are used for warps, and the warps are made by a "Sectional Warping Machine", the yarn comes to the hands of the manufacturer in the form of the hank in which state it is dyed and sized; a drum winding machine is used for winding the yarn from the hank on to Winders bobbins. Fig 4 gives a general view of one of these machines, a line of drums are fixed to a shaft in the centre of the framing, two bobbins rest on each drum, one one each side, and they are carried round by the revolving drum; Fig 5 gives a detailed drawing showing one drum only: A is the drum, about 8" in dia. and just the width of the bobbin B between the flanges (see A and B fig 6), the barrel of the bobbin namely that portion on which the yarn is wound, rests in contact with the revolving drum, and the flanges of the bobbin pass over the edges of the drum on each side, each bobbin has a peg passing through it, which is held by means of the holders b, the bobbin is then driven by the friction generated between the revolving drum and the bobbin, the bobbin holders b can be lifted up, and remove the bobbin from contact with the drum as shown in the bobbin on the left in fig 5; the small projection attached to the holder passing beneath the catch shown, and keeping it up. This is termed the "catch and catch" of a drum machine. The hanks are placed on swifts S, the free end of the thread passes over a rod and through a thread guide D which is worked to & fro horizontally the width of the drum through the train of wheels Q.R.T. The working of the traverse is better shown in a front view fig 6. A is the drum, on the end of the drum shaft is E driving F; F drives G; G drives H; on the same stud as H is K driving L, on the other end of this shaft is a small pinion

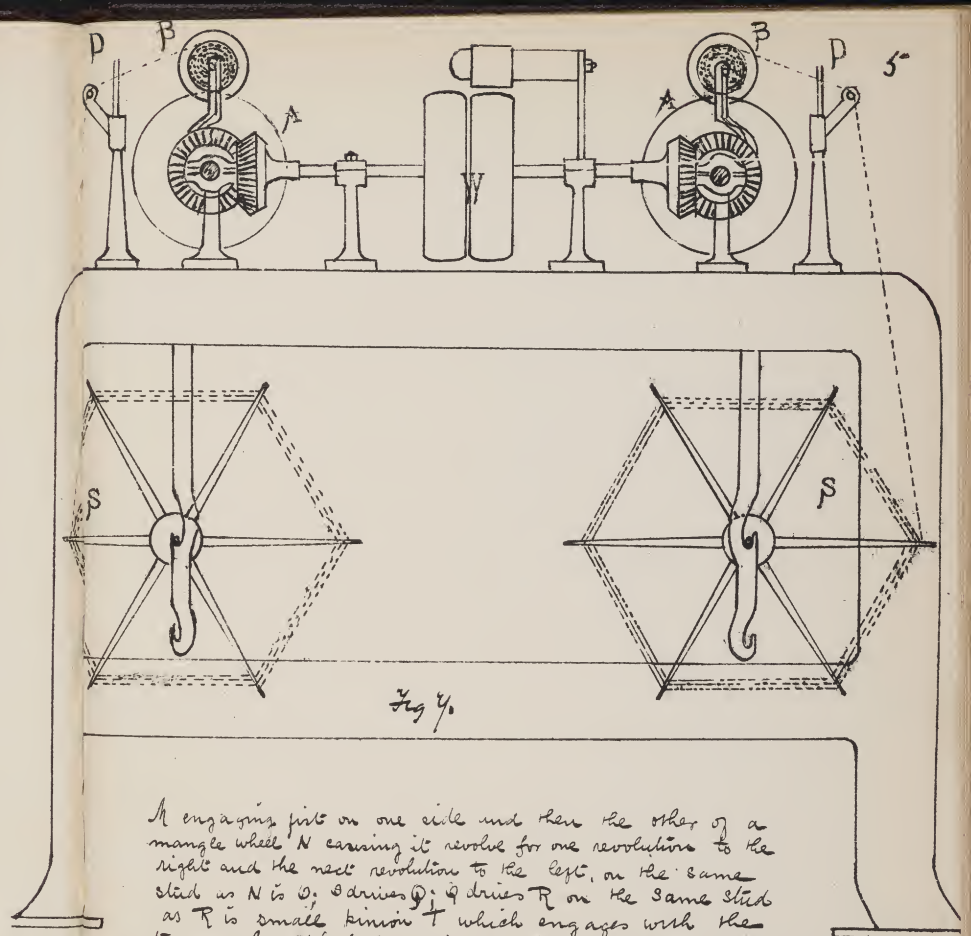


Fig 7.

N engaging first on one side and then the other of a mangle wheel N causing it revolve for one revolution to the right and the next revolution to the left, on the same stud as N is O, O drives P, P drives R on the same stud as R is small pinion T which engages with the traverse bar S (which carries the thread guides.) causing it to move only from side to side, a distance equal to the width of the drum. In use on to paper tubes or bobbins without flanges, a very quick traverse motion is used that the thread is laid more across the face of the tube, than is the case when flanged bobbins are used. Fig 7 illustrates the method of driving when there are two drums, one on each side of the frame and one drum drives one bobbin. W represents the fast and loose driving pulleys, bevel wheels are fixed at each end of the shaftese gear with similair bebel wheels fixed to the drum shafts.

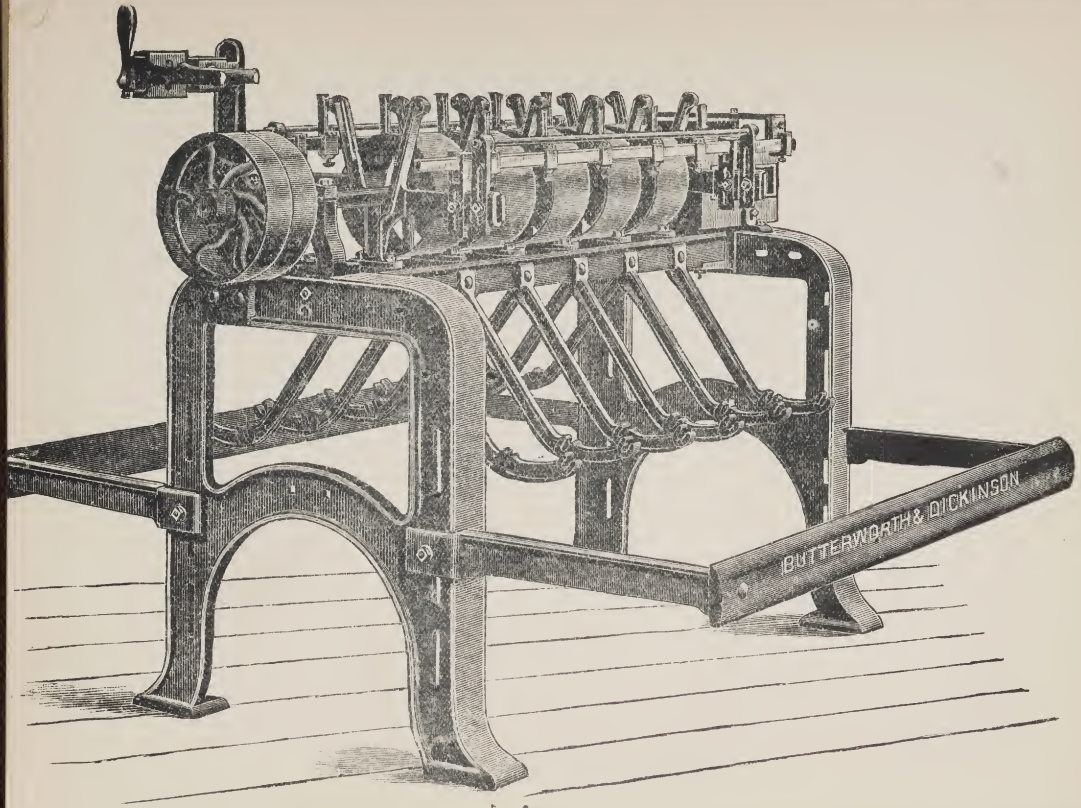


fig 4

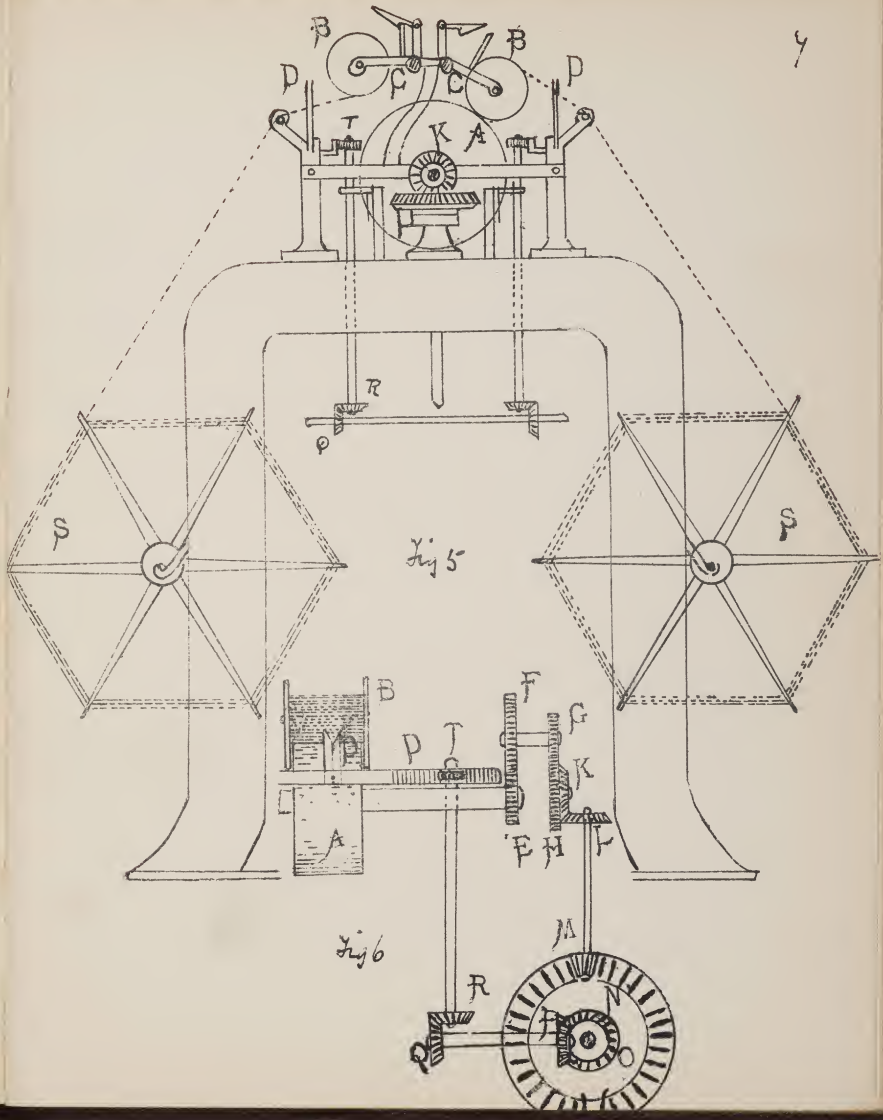


Fig 5

Fig 6

Pirn Winding

When coloured yarns is used for weft it is usual to buy the yarn in the hank in which form it is dyed, and then wind it on to paper or wood pirns or tubes to be used in the loom as weft.

Fig 8 gives an illustration showing a general view of the machine fig 9 gives a more detailed drawing of the principle parts; on each side of the machine are arranged a row of pirn cups E, and as both sides of the machine are alike a description of one side only will be given; passing round the central tin roller A which extends the length of the machine are bands, which in their turn pass round the wharves of the Spindles E, the spindles E have a small hole at the top which passes right through from the top to the bottom of the spindle, fig 10, shows an enlarged view of pirn cup and Spindle the drawing shows a section of the cup and spindle with the spindle which carries the pirn passing through the revolving spindle E; the pirn cup F builds up and gives shape to the pirn, the inside is cone shaped with an opening in front for the passage of the yarn (see fig 11), the Spindle H on which the pirn is placed is loose, and is not fastened in any way to the revolving spindle E, in fig 10 it will be seen that there is a narrow place W in spindle E, at this point a bent spring passes through an opening in the side of the spindle, and its object is this: the end of spindle E for a few inches is flattened, and as this end passes through the spring in Spindle E, the last named carries round the Spindle H and the pirn along with it. In commencing to wind a new pirn, the Spindle H (which has a small weight attached to the top for the purpose of

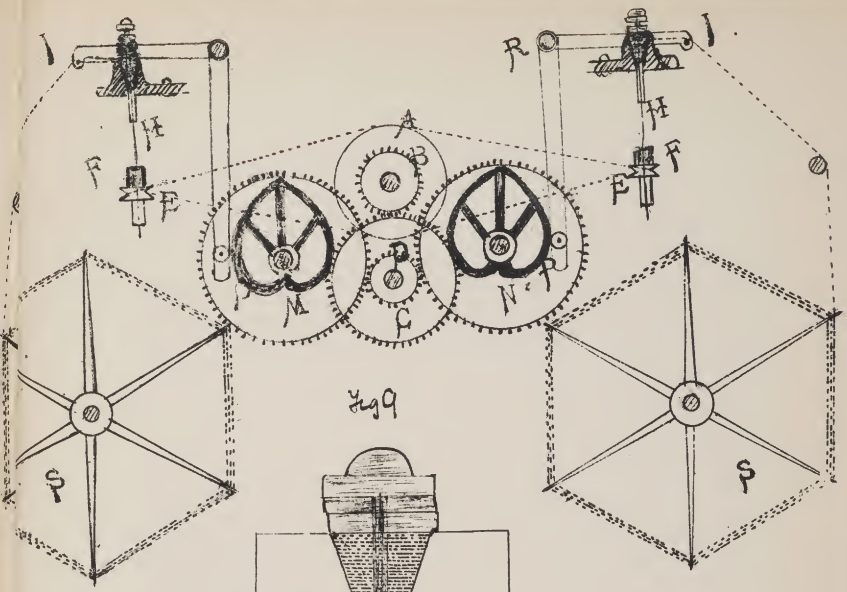


Fig 9

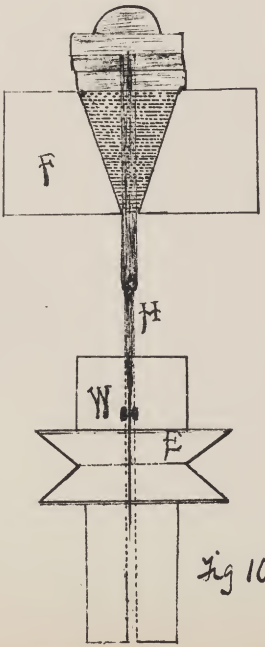


Fig 10

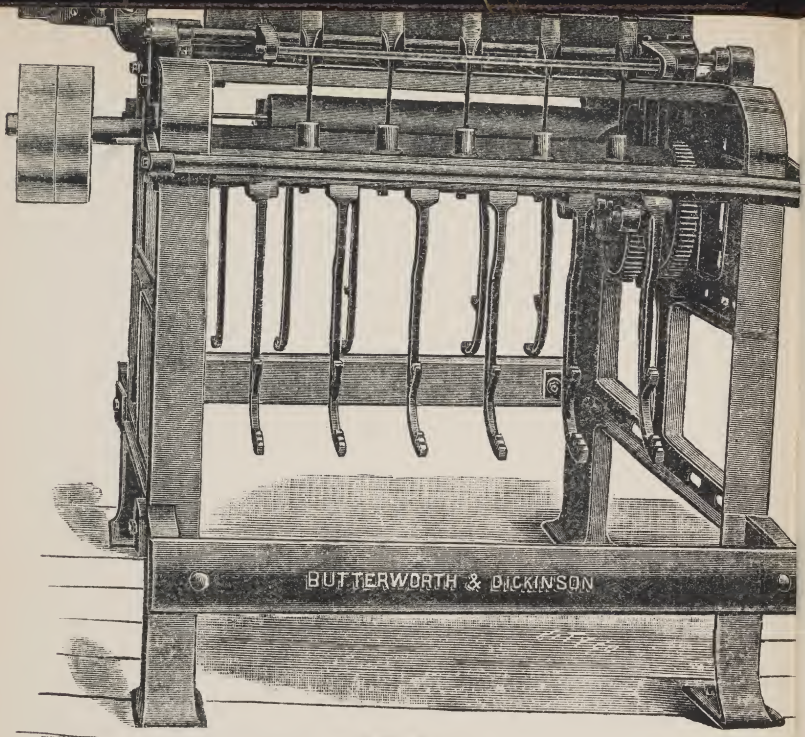


Fig 8

making the yarn lie solid on the pirn) and an empty pirn placed upon it, one or two turns of yarn ~~are~~ from the hank S are wound on, it is then placed in the pirn cup, the lower end of the spindle H passes into the hole of the revolving spindle E, the small flat spring or clip in E, ~~has a way~~ carries round the spindle H and the pirn along with it, winding the yarn from the hank S on to the pirn. The yarn is guided on to the pirn through at traverse bar I over which the yarn passes, it moves through a distance equal to the depth of the cop, Fig 9, on

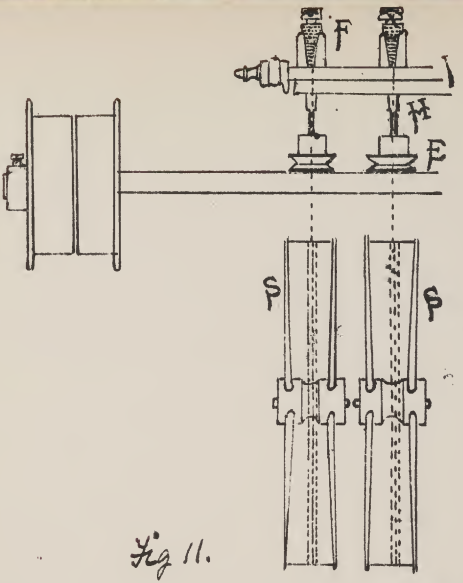


Fig 11.

H.

the two roller shafts is a pinion B driving C; On the same stud as C is pinion D driving M, and N, each of these two wheels carry heart shaped tappets O & P. resting against P is the bell cranked lever with its fulcrum at R. at the free end of the lever is the traverse bar, which moves through the actions of the tappet up and down guiding the yarn on to the pirn; when so much yarn is wound on to ~~the pirn~~ that portion of the pirn which is inside the cup, so that the cup is filled the pirn slowly rises up out of the cup, bringing up fresh surface on which fresh yarn can be wound, the spindle H at the same time slowly rising out of the hole in the revolving spindle E, by the time the pirn is completed. the spindle H will have risen so far out of the revolving spindle E that the clip A will no longer have any control over it, the spindle H will cease revolving and the winding for that particular pirn stopped.

James Holmes M.S.A. Burnley

Beaming Frame.

This machine is used for winding the yarn from the spinning bobbins, on to large beck beams, each of these beams are supplied with from 400 to 500 ends, each end measuring from 13000 to 14500 yards in length according to the counts of yarn used, an ordinary back beam will hold 450 ends of 32's twist. A number of back beams are combined together at the slasher, to obtain the required number of ends for the weavers warp; if a weavers warp of 1800 ends is required, four back beams each containing 450 ends (4 x 450 = 1800) will be put up at the sizing machine.

Fig 11 gives a general view of the machine, detailed drawings of the principle parts of the machine is shown in fig 12. It consists of a V shaped creel for the bobbins, the ends from the bobbins pass through a feed at S, over the measuring roller R, beneath the roller P, over Q under P' over S' over the table T, through the expanding comb V, over a small roller and thence to the beam, the beam rests on the large wood drum A, this drum is driven by a driving pulley fixed on the end of the beam shaft, the beam resting on the drum is driven by frictional contact, so that no matter what the size of the beam may be, whether full or empty, the yarn is always coming from the bobbins at one speed, namely the surface speed of the drum. The rollers P and P' are termed drop rollers, they are held up by means of the sheet of yarn passing beneath them, the axis of the rollers are not in fixed bearings, but in slots which extend from the top to the bottom of the machine; when the machine is coming to a stoppage the bobbins overrun themselves, and the slack yarn is taken up by one or both the drop rollers falling down the slots; in the case of a broken thread the beam is turned back to find it, the drop rollers take up the slack yarn unwound from the beam, before starting the machine again, the beam is pulled round by hand until the rollers are lifted to the top of the slots.

Simpleton's self stopping arrangement is attached to this machine, its object is to stop the machine on the breakage of a single end; as before stated the sheet of yarn passes over the table T of the machine, this table contains three slots extending the width of the machine, beneath are two rollers F + G, the roller to the right hand is by the upright shaft E, F then drives G by means of small pinions fixed on E and each roller, the axis of the roller F is in a fixed bearing, the axis of the roller G passes through the lever H, the fulcrum of H is at I; each thread as it passes over the table of the machine, supports a small piece of bent wire, much resembling a small hair pin, these are kept in position by the three slots; if an end breaks the piece of bent wire (commonly

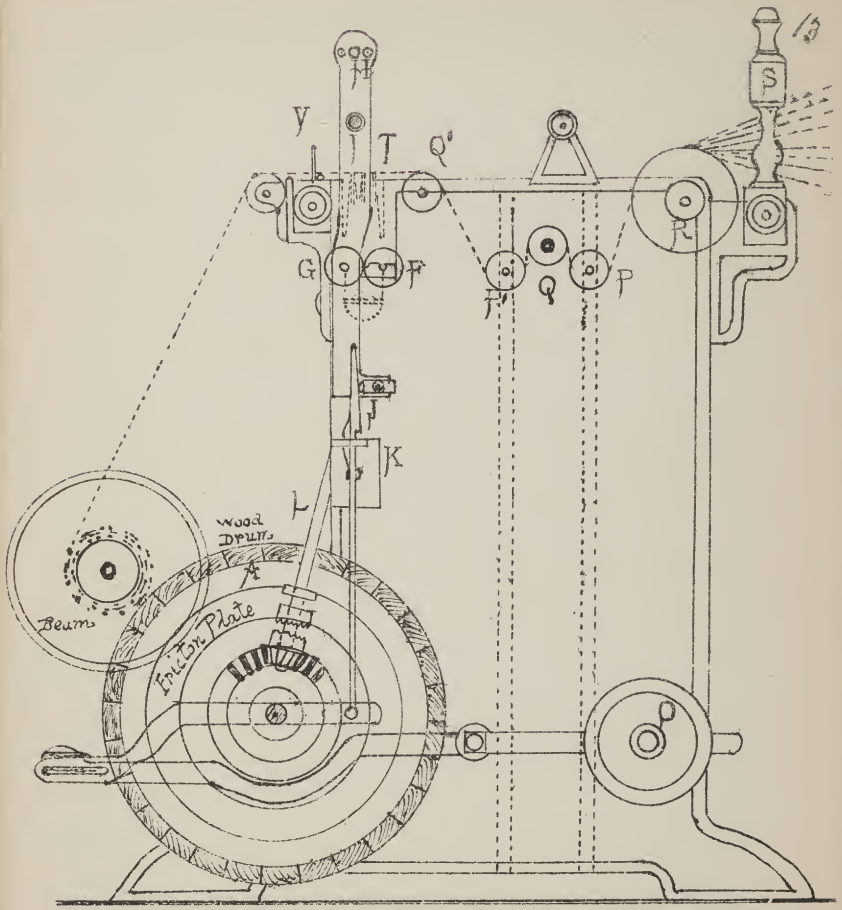
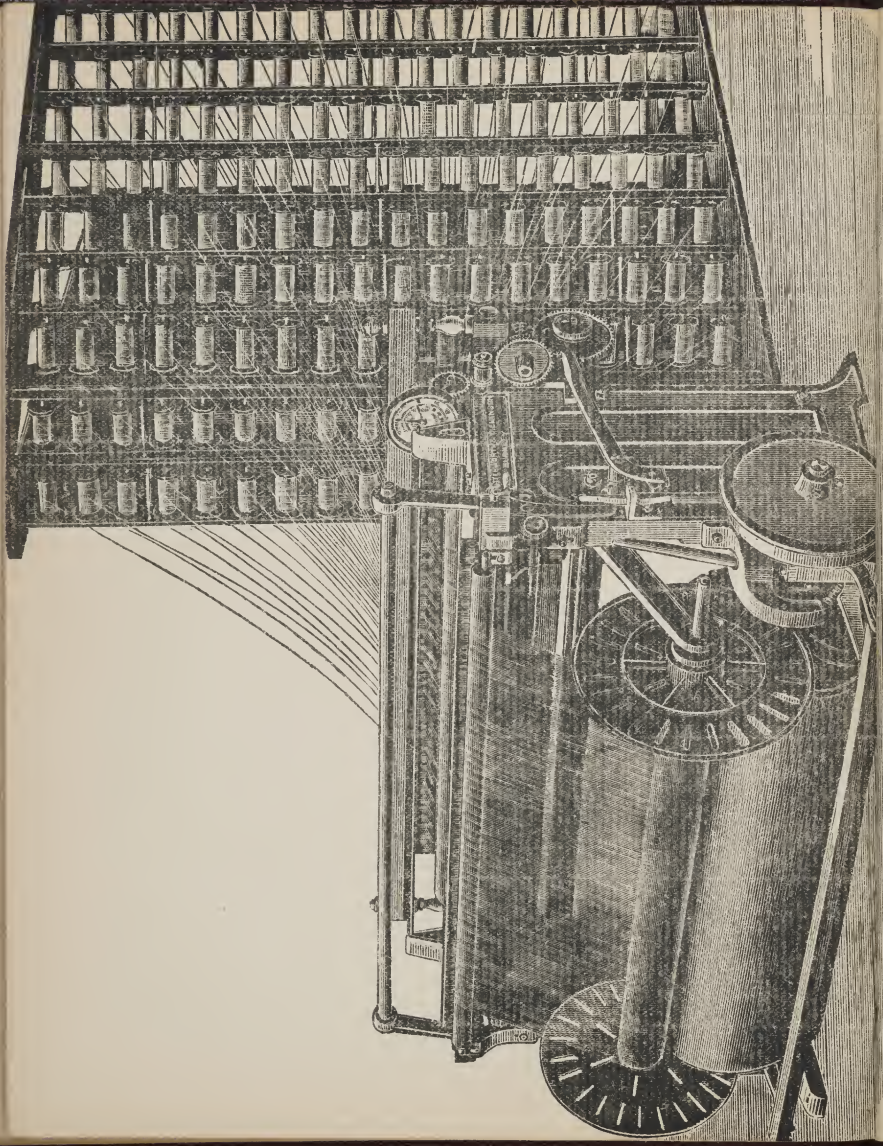


Fig 12



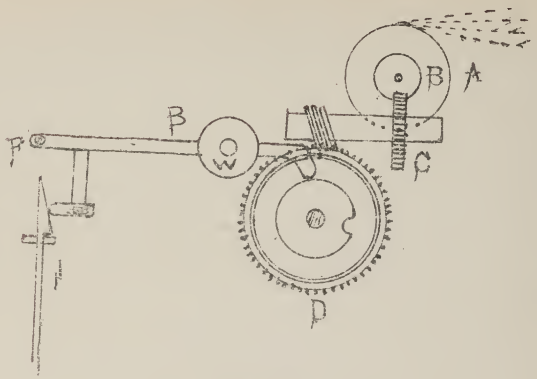


Fig 13

(called pins) it support drops down between the two rollers F & G the entry of the pin causes their reperation, pushing the roller G to the left, carrying with it the lever H, the lower part of which is in close contact with the upright trigger J which is pivoted at K. The support K, when this recess the weight G which is held up by the trigger drops down, and causes the machine to stop. The roller F is driven by shaft L & bevel wheels from the wood worm shaft

Measuring Motion. The measuring of the yarn as it is wounds on to the beam is of the utmost importance. fig 13 gives one simple arrangement for measuring the yarn as it is wound on to the beam. A is a roller 18 inches in circumference over which the yarn passes and carries it round, on the end of A is a worm B driving a worm wheel C of 70 teeth, on the same stud as C is a worm driving the worm wheel D of 100 teeth, for every revolutions of D 3500 yds which equals what is termed one warp have passed the measuring roller the lever arrangement E F J causes the machine to stop at the end of each warp.

Beaming frames should be placed on a firm floor, where there is little vibration, and steady driving is essential, the best results will be obtained by running the machines about 4 to revolutions per minute, warping 32s to 40s yarn.

Machines have lately been introduced for dyeing the yarn on the beam, in the making of coloured goods

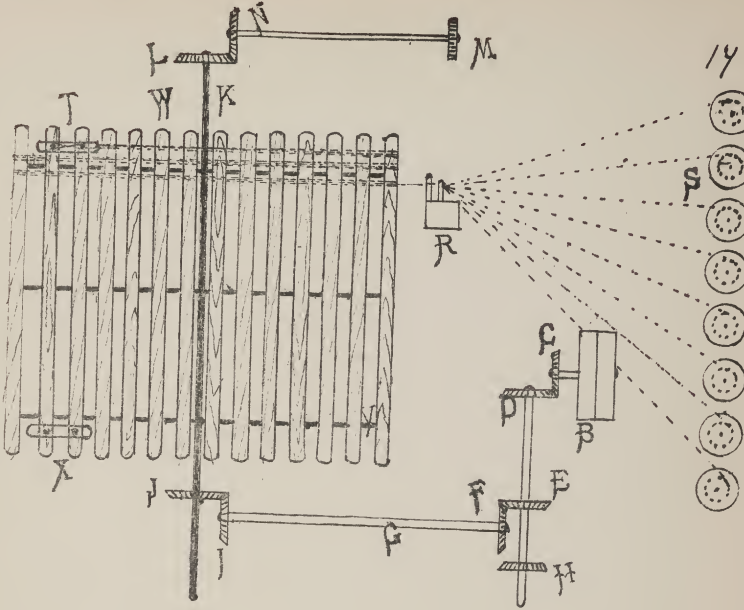
James Holmes M S A

Ball Warping Mill.

This machine is used for winding the yarn from the smaller bobbins in the making of a weavers warp; in the grey trade it is very little used, the Beaming frame a machine of more recent introduction taking its place. It is still very extensively used in the coloured trade; the warps are made in the grey, afterwards dyed and sized from the ball.

Figs 14 and 15 illustrate its parts and working. fig 14 gives elevation and fig 15 plan the same letters refer to the same parts in both illustrations. It consists of a semicircular creel S which holds from 400 to 500 bobbins, a large circular reel or mill W about 12 ft high and from 16 to 20 yards in circumference upon which the yarn is wound spirally, situated between the reel and the creel is the heck R, which serves the double purpose of keeping each thread in position, and guiding the yarn on to the mill: passing up the centre of the mill is the upright shaft H and by means of tie rods Y the mill is fixed to it; B is the driving pulley and through the bevel wheels C. D. E. F. I and J the mill is driven, fixed to the top of the shaft H is the bevel wheel L driving N, on the same shaft as N is the wheel M which moves the heck up and down a distance equal to the depth of the mill.

If a weavers warp of 1600 Ends, 640 yds long is required, 400 bobbins are placed in the creel, the threads from these bobbins pass through the heck which is provided with small pins with eyes at the top, one thread through each hyle, through the pot rail which divides the warp into half beers, between a pair of small rollers fixed to upright studs; the warp is then in the form of a loose untwisted rope; a lease is taken by the heck, so that each end is alternately placed, this end of the warp is then fixed to the lease pegs T at the top of the mill, the mill revolves and the heck slowly descends, guiding the yarn spirally on to the mill, when 40 revolutions have been made using a 16 yards mill, $40 \times 16 = 640$ yds have been wound on, and for convenience sake we will say the heck has reached the bottom of the mill; a lease is taken the yarn is turned on the lease pegs X: the shaft G is lowered so that F is in gear with H, I still remaining in gear with J, by this means the direction of motion of the mill is reversed, the heck ascends just at the same speed as it descended and a second layer of yarn is wound on to the first, when the top of the mill is again reached, the yarn is turned on the lease pegs T, the mill reversed and a third layer wound on to the second and so on until four layers of yarn have been wound on, each layer consists of 400 ends and 40×16 yds = 640 yds in length there are four layers therefore $4 \times 400 = 1600$ ends, the warp therefore consists of 1600 ends 640 yds long. The warps after dyeing and sizing are dressed (twisted & combed) and wound in to the weavers beam, slowly & carefully by the dresser.


N
L
M
T
W
K
S
R
C
D
B
X
F
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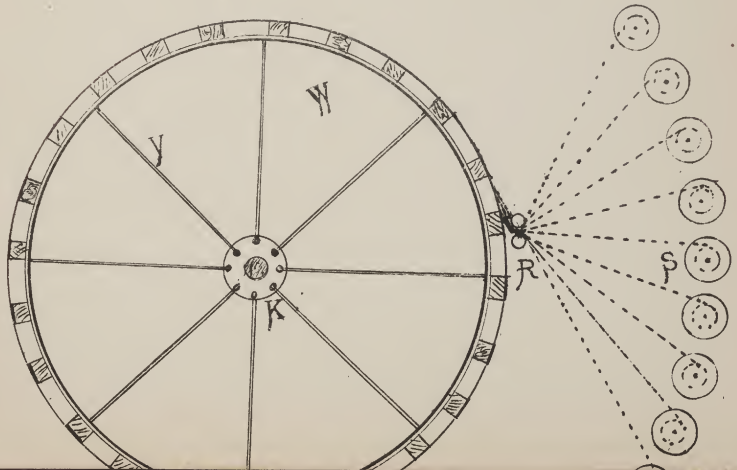
G
H


W
V
R
S
K

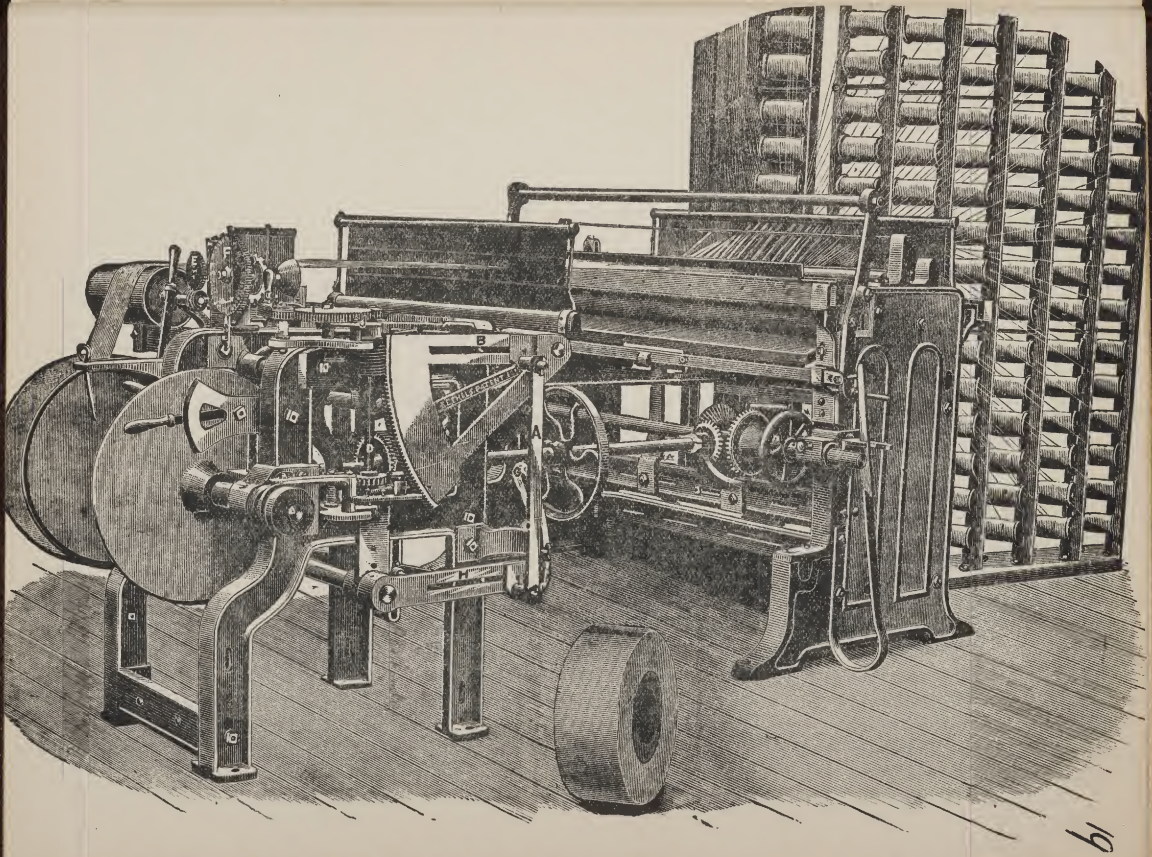
Sectional Warping

Before the introduction of this system of warping if a weavers warp was required made up of several colours of yarn, the method adopted was to have several small warps made on the Ball warping mill, these were dyed the required colours, returned to the manufacturer, and handed over to the dresser whose duty consists in combining these small warps into one warp so many ends of one colour, so many ends another colour according to the pattern required, the ends are drawn through a reed to keep each end in its own position, the end of the warp is then attached to the weavers beam, the beam slowly revolves and winds on the warp, the Dresser brushing the yarn, working the reed backward and forward for the purpose of keeping the warp straight. in Colour weaving districts this system is yet very largely used.

For the purpose of saving time in the preperation of a mixed coloured warp, the Sectional Machine has been introduced see Fig 16 gives a general view of one of these machines, it consists of a creel for bobbins, a self stopping arrangement, in fact the back part of the machine is similar to an ordinary Beaming frame. in front of the machine are two circular plates, one of which is removable, and a wood block about 8" dia, and 6 to 9" across the face is placed between them and made to revolve, the yarn from the creel is wound on to it.

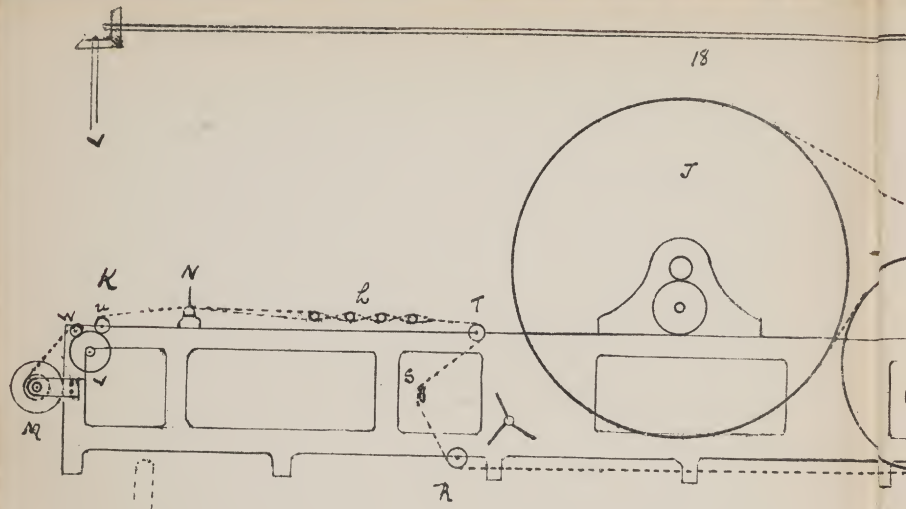
If a weavers warp is required to be made to the following pattern 30 ends Pink 4 Black 10 White 10 Black 10 white 4 black giving 68 ends in one repeat, the weavers warp to contain 2040 ends 400 yards. a section is made consisting of 408 ends or 6 repeats of the pattern 68 × 6 = 408, the bobbins are creeled in the order 30 bobbins Pink, 4 black, 10 white, 10 black, 10 white, and 4 black, this pattern is repeated on the creel 6 times, the ends from the bobbins come to the front, and are wound on to the block between the two plates, until 400 yds is wound on, there being a measuring motion attached to the machine, one of the circular plates or flanges is then removed and the section dropped, it is without flanges and is carefully placed on one side, a fresh block is put into the machine, and another exactly similar section to the 1st is made, this is dropped and so on until 5 sections have been completed each section contains 408, therefore 5 × 408 = 2040 ends the number required in the weavers warp. these sections are then slid upon a bar having at one end a flange, a movable flange is afterwards placed on the other end, it then resembles a weavers beam this is taken to a winding on machine for sectional warping the yarn is unwound from this modified beam on to the weavers beam proper, after having the healds and reeds attached. it is ready for the loom, the yarn having been dyed & sized in the hanks. the principle features of the machine — is the winding of the yarn, so as to make all the sections the same size when the cane ends have been wound on.

James Holme



This machine is in universal use in all cotton weaving districts, by its means a larger quantity of yarn can be sized and wound on to the weavers beam, in a given time than by any other means.
The back beams prepared at the beaming frame, are taken to this machine, where a number of beams are combined together to obtain the required number of ends for the weavers warp.
A sectional view of the machine is shown in fig 14 it consists of the following parts, Creel, Size Box, Drying cylinders, and Headstock.
A is the creel for back beams, arranged so that the beams are in two levels; the size box B which receives the size from the mixing vessels, it contains a copper immersion roller C, under which the yarn passes, it can be raised or lowered by a rack and pinion, there are also two copper rollers D and E, resting on the top of each, are iron rollers F and G, weighing about 4 cwt each, each is covered with several layers of flannell, the sheet of yarn passes between these pairs of rollers, their object is to squeeze out the superfluous size, and return it to the size box; passing round the interior of the box, and resting on the bottom is a copper pipe H, perforated with small holes, through which steam is forced which keeps the size at a constant boil; the drying portion consists of two steam heated cylinders I and J, the larger one is 6 feet in dia. the smaller one 4 feet, both measure about 60 inches in the drying face, the interiors of the cylinders are fitt up with buckets, to collect the water arising from condensed steam, a steam trap is fixed to the floor near to band connected with the cylinders, to carry the water away; the axis on which the cylinders revolve are not in fixed bearings but rest on bowls, so the cylinders are easily carried round by the pull of the yarn, which passes round them.
The Headstock K is at the front of the machine where the yarn is seperated with the opening rods L, measured and marked the required cut lengths and wound upon the weavers beam M.

If a weavers warp of 1800 ends is required 4 back beams of 450 ends each, are taken and placed in the creel, the beams broadest between the flanges, are placed nearest the size box, the narrow beams behind, this is to prevent the sheet of yarn overlapping the flanges, the beam nearest the size box is placed on the lower level; the dotted line in fig 14 shows the direction taken by the yarn; the ends from the 4th beam, pass beneath the 3rd beam and collects the yarn from it, there is now a sheet of yarn of 900 ends, which passes over the 2nd beam collecting its ends, making a sheet of yarn of 1350 ends which passes under the 1st beam collecting its yarn forming a sheet of yarn of 1800 ends, this passes over a small roller O under a drop roller P which takes up the slack yarn when the beams over run themselves, over another small roller Q and into the size box, underneath the immersion roller between the pair of squeezing rollers, over the smaller cylinder without touching it, over the larger cylinder in contact with it, leaving this cylinder it passes over the smaller cylinder in contact with it, leaving this cylinder at the under side, it travels nearly touching the floor in the front of the cylinders over a guide roller R over a flexible bar S over the roller T which guides it to the headstock, between the opening rods L, through the expanding comb N which separates guides it to the required width on the weavers beam, over the measuring roller U, partially round the drag roller V, over roller W and thence to the weavers beam M.
The main driving part of the machine is the drag roller, which pulls the yarn from the cylinders, and delivers it to the weavers beam, the drag roller is connected to the copper rollers in the size box, through bevel wheels and a side shaft shown in plan fig 18, the copper rollers are the same size as the drag roller, these rollers pull the yarn from the creel and deliver it to the cylinders at the same speed, as the drag roller pulls it from the cylinders and delivers



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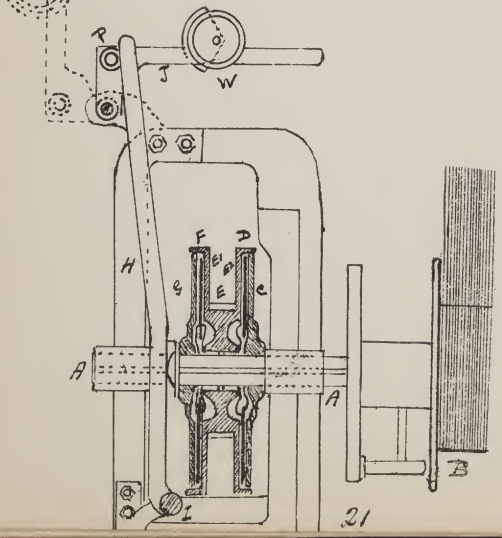

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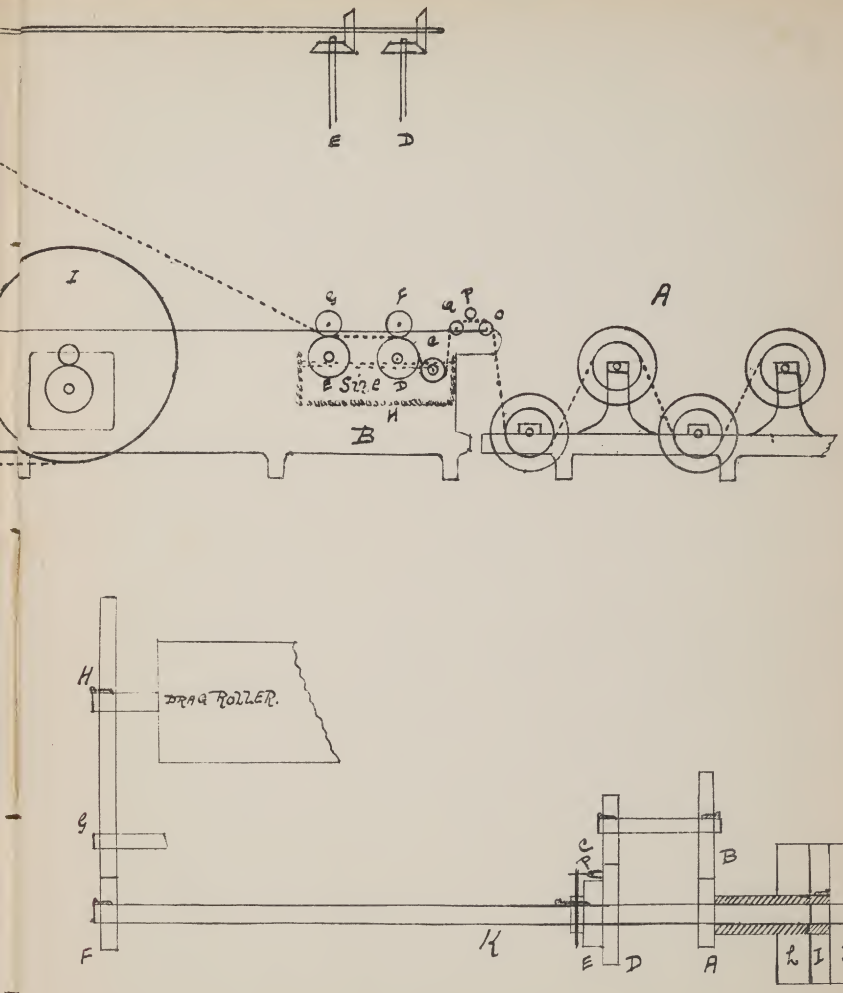

19

H.

roller is generally wrapped with several layers of cotton cloth to increase its diameter. The machine is scarcely ever stopped after the commencement of a beam to its completion, in the event of a tenter, instead of stopping the machine altogether, until the attendant puts it off, the machine is run at a reduced speed, in other words it is put on the slow motion.

Fig 19 illustrates the driving and also the slow motion.

J is the fast driving pulley, fixed to the end of shaft K, at the other end of K is a pinion F driving a carrier G which conveys the motion to the wheel H fixed on the end of the drag roller, and as before stated, this roller is the main driving of the machine, the other motions such as drawing the side shafts and the weavers beam are derived from it, therefore when the straps is on J the machine is running at full speed. I is a thin pulley fixed to a long collar which rides loosely on the shaft K, on the end of the collar is a pinion A gearing with B, on the same stud as B is a small pinion C gearing with D, the wheels A and D ride loosely on shaft K, in close contact with D but keyed to the shaft K is the ratchet wheel E, when the driving straps is put on to pulley I the train of wheels A. B. C. D, are set in motion, and as small pinion A.C. are driving larger wheels B.D. the last wheel in the train, D, is running at a reduced speed, but D rides loose on the shaft K, but the slow motion of D is communicated to the shaft K through a pawl P and steel bent spring as shown in fig 20. which shows an end view of shaft K and wheels D and E: the loose pulley I rides loosely on the collar to which the slow motion pulley is fixed.

Fig 21, shows the arrangements for driving the weavers beam at a diminishing speed as it increases in size: the beam is driven by friction at a speed just sufficient to take up the yarn as it is delivered by the drag roller; A is the shaft to which the weavers beam B is fixed, C a circular plate loose on shaft A: D a circular plate covered with flannel on each side fixed to shaft A: F a similar plate to D and like it fixed to shaft A: E a wheel with circular flanges E1 and E2 fixed one on each side of it they ride loosely on shaft A, G a circular plate like C it rides loose on the shaft: H a lever with its fulcrum at I presses against the outside plate G: J another lever with a small pin P fixed to it, the pin rests in contact with the upper part of lever H: lever J is weighted by W. the wheel E is driven positively by means of the wheel fixed on the end of the drag roller shaft, and if the plates are not pressed together, the wheel rides loosely on shaft A and no motion is conveyed to the beam, but if the plates are pressed as firmly as possible together, the friction generated between the plates is so great that the flannel covered plates D and F which are fixed to the shaft are carried round at almost the same speed as the wheel E, and the beam is likewise made to revolve at the same speed as the wheel, so that by regulating the pressure on the plates the beam can be driven at any speed short of the actual speed of wheel E: the lever H and I with the weight W are used to regulate the pressure on the plates, after the weight has been set on the lever I for a given beam, it requires no further attention, though in practice many tapers move the weight slightly along the lever, or turn the movable weight over when the beam is about half full the intention being that by so doing a much firmer beam is made.

The Presser of which there are many forms, presses each layer of yarn as it is wound on to the weavers beam, in close contact with the layer of yarn previously deposited.

The Fan is for the purpose of cooling the yarn as it is wound on to the beam. The starting handle is connected with a valve, which shuts off steam to the cylinders when the machine is stopped.

Air Valves are fixed to each cylinder to prevent collapse in case a partial vacuum is formed inside.

Measuring & Marking Motions (See "Calculations in Cotton Weaving" Holmes pp 78 & 49

Bell Wheel 45 teeth.
circ. of Meas. R. 14. 4 inches
Stud Wheel. } Equals Tin Roller Wheel
length of Mark in inches

Jas Holmes M.C.A. Burnley

Sizing Substances

This process is the most important of all the processes connected with manufacturing, and if it is well done, good results and a fair average mean is secured: but if the sizing be imperfectly performed, then no matter how good a class of work people may be employed, the results are bad both in respect to production and quality; profit is spoiled, and bad cloth the result. So much attention cannot be devoted to this part of the subject.

The object of sizing the yarn is to make it stronger and better able to withstand the firming action of the reed; the substances used in the sizing mixing may be conveniently placed under five heads.

Adhesive Substances used for adhesive purposes, are such as contain a large quantity of starch, as Flour, Farina, Sago, Corn Starch and many others; Flour is the most important, and is always kept when heavy sizing is adopted, it contains in addition to starch, Gluten and Dextrine, which have powerful adhesive properties, it is generally fermented before using, the products of fermentation preventing mildew. The flour is mixed with water and allowed to ferment in a separate beck, one beck about 7 or 10 ft long and 4 ft 6 deep is separated by a division in the centre which reaches to within about 3" from the top of the beck, two becks are by this means obtained, each measuring about 4 ft 6" square, agitators or dashers are fixed in each beck and work continually.

One method of allowing the flour to ferment and which is practised with success by a large firm using from 20 to 60 Cwt per week, weaving many varieties of cloth such as plain, twills, sateens, dobbies and Jacquards, the sizes are sized for weaving only and not for weight is as follows. "about 3" of water is run into the beck, the agitators set to work and one sack of flour is added, a scoop-full at a time, let this work up for a day, on the following day add two more sacks of flour in the same way, and a corresponding amount of water, just so much water is run in that the mixture does not become so thick as to stop the agitators. The day following add two more sacks of flour, and more water, and so on until about 7 or 8 sacks are mixing in the beck; the beck must not be filled to within about 10 or 12" from the top, or it might overflow when the flour ferments freely, but seeing that the division which separates the two becks does not come to the top, if the flour does ferment too freely, it can only overflow into the other beck; after working a few days it will assume a density of about 30 to 34 degrees Twaddell, if it be too thick add a little more water, if too thin a little more flour the agitators are allowed to work constantly, and the flour is allowed to ferment for 3 weeks before using; during the time the flour is being used out of this beck, another lot of flour and water is allowed to ferment in the same way in the other beck. So that by the time one beck is empty another is ready for use. Other two becks are used in which the different ingredients used for the mixing purpose are placed and boiled and then supplied to the slasher, so that four becks are required for each slasher machine. If China clay is used, another seperate boiling pan is required.

Farina is a valuable and most useful ingredient, and mixed half and half with flour along with a quantity of tallow makes a good mixing for lightly sized goods. Care must be taken that the water

used is not too hot at the time of adding the farina, or it will go into lumps and spoil the mixing.

Corn Starch has the same properties as farina, it is quite as good and if it be cheaper it can with safety be used in the same way and in the same quantities as farina.

Sago Flour is used along with flour and gives good results, it is said to add a certain amount of elasticity to the yarn, it also imparts a harsh feel, but this may be overcome by using a little more flour.

Gum Tragacanth is valuable if heavy sizing is adopted, it is rather expensive, and only a small quantity is used; it is in the form of small chips resembling horn and before using, it is allowed to stand mixed with water for about 2 weeks, by that time it will have gone into a pulpy mass, and is then ready for use: if it is allowed to stand for two weeks it will be ready for use sooner.

Brown Sugar about 1 lb to each set, where 50° or 60° yarn is used, will be found to be very good, it imparts a certain amount of elasticity to the yarn, and the warps will weave better for it

Weight giving Substances includes the following.

China Clay is used in all heavy mixings, it is boiled in a seperate pan along with the tallow for several hours before it is added to the mixing, the longer it is boiled and the better, it should be perfectly smooth and free from gritty matter. French Chalk, Sulphate of magnesia or Epsom salts are sometimes used for giving weight.

Softening Substances include the following— Tallow. Bleached palm oil, Castor oil, Sperm oil, Paraffin Wax, they are of a greasy nature, introduced to keep the yarn soft, they also enable the yarn to better leave the cylinder in the drying of the yarn after sizing.

Tallow is the most important, it should be free from smell, and should not go rancid on exposure, or with keeping.

Bleached Palm oil is used in light sizing

Castor Oil and Sperm Oil are used in heavy sizing.

Paraffin wax is used for giving the yarn a good finish and improving the weaving qualities of the yarn, but a large quantity is very objectionable, it cannot be removed in the process of bleaching and scouring, it does not take the colours properly but leaves white specks and splotches when printed, it is quite a common thing in North East Lancashire if a weaver has a bad warp to plaster a few wax candles between the beam and the sheet of yarn as it leaves the beam, for the purpose of improving the weaving; there is a firm in Manchester who make wax rods for this purpose.

Substances used for giving weight and improving the weaving. Chloride of Magnesium

is the most important and is of great value, if used with discretion, its value depends upon its affinity for moisture, and when used in a mixing it keeps the yarn in the most favourable condition for weaving, if too much is used, the goods will be damp and liable to mildew, it should be used along with chloride of zinc to prevent mildew. It is bought in the crystals, and a quantity is placed in a bucket and steam blown into it until it is reduced to a solution of 56° T before using. Glycerine Grape Sugar, Soft Soap are occasionally used

Substances to prevent Mildew or Antiseptics

Chloride of zinc is generally used for this purpose it is reduced to a solution of 12° T before using. Carbolic acid is sometimes used but the smell is an objection.

Size Mixing

Where the slasher is the machine used for sizing the yarn four becks are used two for the flour two for the mixing proper. This enables one of the flour becks to be used for fermenting flour whilst using out of the other one, and also whilst using the size out of one mixing beck, a fresh mixing can be made in the other one.
The number of size mixings in use for the different marks of cloth are almost innumerable, a fair knowledge of the properties of the different substances, will enable one to make a mixing for any cloth with a tolerable amount of success, but practical experience will be the best guide
The first thing will be to determine the amount of weight required on the yarn, and then assuming that the sized yarn contains the same amount of moisture as the unsized yarn, the amount of solid matter put into the mixing, will be the difference in weight between the sized and unsized yarn. allowing a reasonable amount for loss in waste. The condensed water from the cylinders is used for mixing purposes.
In sizing for a set of weavers beams each beam to contain 1600 ends the total length of yarn on the back beams 17,500 yds.
The sized yarn is equal 32^s twist, the unsized yarn when put up at the slasher will equal 34^s, the rest of the weight to make it equal to 32^s will be Size.
The unsized set weighs

$$\frac{17500 \times 1600}{840 \times 34} = 980 \text{ lbs.}$$

The sized yarn to equal

$$\frac{17500 \times 1600}{840 \times 32} = 1041 \text{ lbs}$$

The difference between the two weights is 1041 − 980 = 61 lbs of Size.
The mixing therefore used for sizing the set must contain at least 61 lbs of solid matter. The size of the beck used is 4 ft 3" square it is filled about half way then and.

Farina 28 lbs.
Flour 340 lbs at 34°T reckoning ⅔ of this water it gives 113 lbs solid matter
Tallow 10 lbs

Then boil up by blowing in steam until the mixture begins to bubble through freely, shut off the steam and it is ready for use. this mixing will be sufficient to size two sets each set containing 1600 ends 17,500 yds length one set is 61 lbs light of that will be the difference in weight between unsized & the sized yarn. The amount of solid matter in the mixing may roughly be stated as follows.

Farina 28 lbs
Flour 113 "
Tallow 5 "
146 lbs solid matter

The flour at 34°T will contain about one third of solid matter, and the tallow will probably lose half its weight in water the amount of size required is 122 lbs to make the 34^s yarn equal 32^s, in the mixing there is in the mixing 146 lbs of solid matter leaving a margin of 24 lbs or 12 lbs per set. which can be easily accounted for waste & is rubbed off in weaving.

The above set of weights and mixing along with the mode of preparing the mixing are taken from actual practice and with slight alteration it is the method adopted in weaving districts where Burnley printers, sateens, drills, Jeans, are woven. 27

Another mixing is given for 55s twist the unsized yarn equals 52s but when woven into cloth it equals with the addition of size 57s

Farina 56 lb
Sago 56 "
Flour 140 " at 34°T
Tallow 10

Sufficient to size two sets each 14500 yds in length.
Size of beck 4 ft 3" square, mixed in the same way as the previous one
For a Flour mixing

Flour 408 lb
Tallow 10 "

Suitable two sets, the sized yarn to equal 30s the unsized yarn to equal 32s 15000 yds.
These mixings are for what are termed the pure sized goods, simply sized for weaving only. another system is to add the substances and water together then Twaddel to about 8 or 10 degrees.
The following mixings are said to give the following results.
For 10 per cent

200 lbs Farina
20 " wax
200 gallons of water

For medium sizing say 50 per cent.

480 lb Flour
224 lb Clay
60 " Tallow
Magnesium. 5 gallons (about 18 lbs)
Zinc. 2 " (" 14 ")
150 gallons of water

For heavy sizing 100 per cent.

560 lb Flour
560 " Clay
130 " Tallow
Magnesium 20 gallons. (about 46 lb)
Zinc - 10 " (" 40 ")

The hydrometer is an instrument used for measuring the density of liquids it is generally known as a Twaddle,

To obtain	25/50 %	50/100 %	100/200 %
should Twaddle	15°	25	40°

James Holmes ASA Burnley.